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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Second Annual Meeting, American Gas Institute.

AMERICAN GAS INSTITUTE,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., Sept. 11, 1907.

To the Members, American Gas Institute: The second annual meeting of the American Gas Institute will be held at Washington, D. C., October 16, 17 and 18, and will be called to order by the President, Walton Clark, of Philadelphia. The New Willard Hotel has been chosen as headquarters, and the sessions will be held in the auditorium thereof.

The following schedule of rates offered by various hotels in Washington are submitted:

		Without Bath — One Person.		Without Bath — Two Persons.		With Bath — One Person.		With Bath — Two Persons.	
		Single Room.	Double Room.	Double Room.	Extra Large Room.	Single Room.	Double Room.	Double Room.	Extra Large Room.
New Willard.	E	$2.50 up.	$3.00 up	....	$4.00 up.	$3.50 up.	$4.00 up.	$5.00 up.	$5.50 up.
Raleigh.....	E	2.00	3.00	4.00	4.00	3.00	4.00	4.00	6.00
		....	....	....	....	3.50		6.00	up.
Occidental.....	E	Suites, 2 bedrooms, Parlor and bath, $4 and $5							
Shoreham	E	2.00	3.00	4.00	5.00	3.00	4.00	5.00	7.00
	A	4.00	5.00	8.00	9.00	5.00	6.00	9.00	11.00
Arlington	E	2.00	....	4.00	4.00	3.00	...	5.00	5.00
	A	4.00	....	4.00	8.00	5.00	....	9.00	9.00
Normandie ...	E	1.50	2.00	2.00	2.50	2.00	3.00	4.00	4.00
	A	3.00	3.50	5.00	6.00	3.50	5.00	8.00	8.00
Riggs House..	A	3.00	3.50	6.00	7.00	4.00	5.00	8.00	10.00
Grafton	A	3.00	3.50	6.00	....	5.00	6.00	8.00	....
		....	5.00	8.00	....	....	....	9.00	....
Cochran.....	A	....	....	....	....	....	4.00	7.00	....
Metropolitan..	E	1.00	2.00	2.00	3.00	2.00	2.50	4.00	6.00
		....	....	....	....	....	3.00	....	up
	A	2.50	3.00	5.00	6.00	3.50	4.00	7.00	8.00 up
Ebbitt	A	3.00	....	6.00	....	5.00	6.00	10.00	....
		4.00	....	up	....	....	....	....	....
St. James. ...	E	1.00	2.50	3.00	....	2.50	3.00	4.00	....
		2.00	4.00	4.00	....	3.00	4.00	6.00	....
National.. ...	E	1.00	2.00	2.50	3.00	2.00	....	4.00	....
		....	....	....	....	2.50	....	....	....
		2.50	3.00	5.00	6.00	3.50	....	7.00	....
		....	....	....	....	4.00	....	....	....
Howard House	E	2.00	....	2.00	6.00	....	....	....	....
		2.00	....	2.50	....	....	....	....	....

E—European Plan. A—American Plan.

The following order of proceedings will be adhered to as far as possible:

WEDNESDAY, OCTOBER 16TH.—MORNING SESSION, 10 TO 12 M.

Address of Welcome; by Hon. H. B. MacFarland, President of the Board of Commissioners, District of Columbia.
Reply by Mr. Wm. E. McKay, Boston, Mass.
President's Address.
Report of Board of Directors.
Report of Trustees, Gas Educational Fund.
"The Obligations Imposed by the Possession of a Franchise," by Mr. Charles H. Dickey.
Report of Nominating Committee.

AFTERNOON SESSION, 2 to 4:30.

"Depreciation;" by Dr. A. C. Humphreys.
Communication from New England Association of Gas Engineers; by Its Committee on Uniform Accounting and Depreciation.
Report of Public Policy Committee; Mr. E. G. Cowdery, Chairman.
Report of Committee on Rates; Mr. W. H. Gardiner, Chairman.

THURSDAY, OCTOBER 17TH.—MORNING SESSION, 10 to 12 M.

Report of Committee on Methods of Taking Candle Power; by Mr. W. H. Gartley, Chairman.
"Instructions for Operating Recuperative Benches;" by Mr. W. Baehr.

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OCT 7 1907
SMITHSONIAN DEPOSIT.

Report of Board of Revision of the Question Box on "Manufacture of Gas;" by Mr. J. D. Shattuck, Chairman.
Report of Committee on Economic Balance between Calorific Value and Candle Power; Mr. T. D. Miller, Chairman.

AFTERNOON SESSION.—2 to 4:30.

Report of Committee on Electrolysis; Mr. A. G. Glasgow, Chairman.
Lecture on "Electrolysis;" by Prof. A. F. Ganz.
Report of Committee on Pipe Standards; Mr. Walton Forstall, Chairman.
Report of Bureau of Information, Mr. W. H. Gartley, Chairman.

FRIDAY, OCTOBER 18TH.—MORNING SESSION, 10 to 12 M.

"Air Blast Gas Appliances," by Messrs. W. K. Eavenson, Philip Cross and W. H. Allen.
Report of Committee on Uniformity of Meters; Mr. C. H. Dickey, Chairman.
Report on "A" Meter Results from Philadelphia, Kansas City, Mo., and Kansas City, Kas.
Experiences with Dipping Meters.

AFTERNOON SESSION.—2 to 4:30.

Wrinkle Department, by Mr. M. R. Bump, Editor.

The remainder of this session is reserved for any papers or reports, time for which may not be found according to the programme as above outlined, and for any other business that may come up.

The Passenger Associations, on account of State legislative enactments of 2-cent rates, have refused to grant reduction rates on certificate plan for persons attending the convention, which in substance is the same as received from other Passenger Associations, as follows:

NEW YORK, SEPTEMBER 23, 1907.

MR. JAS. W. DUNBAR, Sec. American Gas Institute, New Albany, Ind.:

Dear Sir—Referring to your favor of the 31st ult., and previous correspondence, beg to advise that your application for reduced rates, account above occasion, was carefully considered by the Trunk Lines at their meeting yesterday, but in view of the unsettled rate conditions throughout the country they deemed it inexpedient to grant any concession.

Yours truly,
L. P. FARMER, Commissioner.

Mr. Charles H. Dickey, Chairman of the Committee of Arrangements, announces as follows:

"The arrangements that the Committee have made for the meeting in Washington are: An excursion for the ladies on Thursday to the Great Falls of the Potomac, where lunch on will be served. Should it rain that day the trip will be abandoned and a luncheon will be served in the city. Thursday evening there will be a theater party for the ladies. The banquet will be held Thursday evening in the New Willard, and the charge for same, to include everything complete, will be $7.50. Members accompanied by ladies will be assessed $2.50 for each lady in their respective parties."

The Secretary will be pleased to mail applications to those who may wish to become members of the Institute. Further detailed information in reference to the convention will be forthcoming.

Yours truly, JAMES W. DUNBAR, Secretary.

[NOTICE.]

Wrinkle Department, the American Gas Institute.

To the Membership, American Gas Institute: All members of the American Gas Institute, and others interested, are requested to contribute a description of any novel device or scheme covering any feature of the gas business. Every department of every company uses some novel stunt which would be of value to others. The object of this department is to compile such information. The value of the report depends entirely on the co-operation received. Send in your contribution at once to

MILAN R. BUMP, Editor,
60 Wall street, New York.

BRIEFLY TOLD.

THE MEETING OF THE INSTITUTE AT WASHINGTON.—Next week the annual meeting of the American Gas Institute will be held in Washington, the business sessions having been named for Wednesday and Thursday, and the morning of Friday, which arrangement certainly looks that sufficient time has been allotted to the clean clearing up of the matter prearranged from the technical standpoint. Every indication favors the belief that the convention will be a decidedly noteworthy one in the making of history for Gas Association work in this country. The programme is given in our official notice herewith, and it is certain that not a listed number on it will be slighted. Mr. Chas. H. Dickey and his associates on the respective committees of arrangement and entertainment have done everything in their power possible to in advance prepare for the reception and the entertaining of those who will make the journey to Washington. That their efforts shall be all the more effective and resultful, it is not only right that the prospective visitors shall aid in the work (and right hard work it is), but that it is incumbent upon them to do so. The greatest aid that can be rendered now is to at once return to Mr. Dickey, at his address, Box 773, Baltimore, Md., the postal card inquiries that have been mailed to every member and to all invited guests, properly answered as to queries made. As Mr. Dickey and his aides declare, it is necessary that prompt and certain replies be made: First, to enable the committee to have a clear knowledge as to how many members will be present; second, to know how many members will attend the banquet; third, information as to how many ladies will grace the occasion with their presence. This does not involve much labor, but it will be of immense assistance to the committee and of real importance in resulting benefit to those who are to be in Washington on the days named. It may seem a trifle ridiculous to again urge the necessity of securing quarters as far in advance as possible, but such appeal is here made. That preparation cannot be too speedily made; and although Washington is plentifully equipped with hotels, it should be remembered that as a city it is more taken up by visitors at this season than at any other, for now it is clothed in all the splendid glories that go to make up the harmonies of the Indian summer days.

THIRD ANNUAL MEETING EMPIRE STATE, GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION.—The Third Annual Joint Meeting of the Association was successfully brought off last week, a good attendance, excellent weather, smoothly directed executive management and close attention to business being the main characteristics of the sessions. It might be said that the attendance was not only large but also fully representative of the three great industries it represented. What might be termed the prelude was the session held in the Concert Hall of Madison Square Garden the evening of Tuesday. That evening four numbers of great interest were pointedly presented. The Honorable Frank Stevens, Chairman Public Service Commission, Second New York District, outlined the work of the Commission and its policies as to the corporations with which it is to have concern, and if in practice he and his fellows stick to his then interpretation of that which the Commission was formed to do, well and good. However, that is another story; and to tell the truth neither the gas nor electric men could forecast much from out of what Chairman Stevens said, for his remarks were mainly directed to the long and short railroad systems of the State. The argument by Dr. Alexander C. Humphreys, on the "Control of Gas Companies by State Commissions," was in that gentleman's best vein and we are sure that Commissioner Stevens got a pointer or two from it, since it is certain that he listened with close intentness to the Doctor's manner and way of putting the subject. Another one who listened well was the veteran member of the Massachusetts Board of Gas and Electric Commission—Mr. Forrest E. Barker—whose facial play, during the Humphreys' recital, was indeed worth noting. Mr. Everett W. Burdett's speech on "Public Control from the Corporate Standpoint," was without question an exceedingly able and forceful argument and presentation of the subject, and it is a certainty that the Chairman of the Commitlee on Public Policy of the National Electric Light Association does not enter into an argument of this sort unprepared by study. The general programme of the meeting next day, which was held in the Edison Auditorium both morning and afternoon, was well occupied by routine and original work which was of the useful sort, although we imagine the debate or the tangle in which a certain committee managed to put itself was too great a time occupier. However, Messrs. Morris and Searle will have a chance on the "Publicity Point" of the work later on. Perhaps they can do something of note in the disentangling line. If they cannot, then the deluge. The officers elected were: President, S. R Bradley, Nyack; Vice-President, J. F. Glidden, Binghampton; Treasurer, T. O. Horton, Staten Island; additional members, Executive Committee, W. T. Morris and R. M. Searle. The paper by Mr. E. L. Elliott, on "Buying Light," was especially well received; as was "The Meter Testing Situation, and Report of Meter Committee," by Mr. R. M. Searle. There was quite an accession to the membership, which is as it should have been.

PERSONAL.—After 22 years of loyal and efficient service with the George M. Clark & Co. Division of the American Stove Company, and its predecessors in business, Mr. Fred. K. Wells has resigned his position as Sales' Agent for New England and the Atlantic Coast States, to go into business for himself. He was succeeded by Mr. Irvin W. Peffly, October 1st. Mr. Peffly has held for many years a confidential position in the Chicago office, and is well fitted to take good care of the large and growing Eastern demand for the Jewel line. His Company bespeaks for him the same cordial reception and generous patronage which were enjoyed by Mr. Wells, who certainly was not the least jewel in the Company's crown.

Address of the President (Mr. John Martin) of the Pacific Coast Gas Association, on the Occasion of Its 15th Meeting, Santa Cruz, Cal., September 17, 18 and 19, 1907.

Members of the Pacific Coast Gas Association: During the past 12 m nth many changes have taken place. Probably the most important to the gas fraternity occurred 11 months ago to day, when the Ohio, American and Western Gas Associations were indissolubly united at Chicago under the name of "The American Gas Institute." Several members of the Pacific Coast Gas Association were in attendance, and one member was honored by being placed on its directorate. From a perusal of its proceedings the members of all Gas Associations will derive much profitable information.

One of the most important papers read at that meeting was written by our worthy past-President, Mr. E. C. Jones, entitled, "The Effects of High Pressure upon Illuminating Gas." The subject matter was entirely original, and I believe will prove to be the foundation of much greater research and determination by the engineers of the United States and Europe, and the results which will be obtained will undoubtedly mark a new era in the science of gas manufacture and distribution. It is indeed a proud moment for us to appreciate that one of the members of the Pacific Coast Gas Association has again pioneered and blazed the way for his successors.

The fact that territorial associations contributed valuable papers to the initial meeting of the American Gas Institute was fully appreciated and full credit was given. It is evident that this national organization is *persona grata* to the fraternity at large. The existence of this national institution should spur on the members of the Pacific Coast Gas Association to greater and nobler achievements. Let us vie with one another in a desire to solve the problems which have confronted us so that our burdens may be lightened. I know that every member of this Association will join me in extending our best wishes to the American Gas Institute and for its success.

Another very great and important change affecting all gas companies on the Pacific Coast, and probably elsewhere, has been the very marked increase in the cost of materials and labor necessary for gas manufacture, distribution and construction. This applies to the electrical fraternity with equal force. In our own territory a very large advance has been made in the price of crude oil within recent months, which will affect all companies seriously. This c mmodity furnishes the basis of manufacture for more than eight-tenths of the artificial gas manufactured on the Pacific Coast.

When we consider that the general policy of all gas and electric companies for many years past has been to try to reduce the cost of manufacture and distribution, so that the public should obtain more of their product for a dollar than heretofore, without financial loss to the company; and, furthermore, that the efforts of the managers of these companies have been successful in making these reductions annually and bi-annually, it now becomes a serious question how to meet the exigencies of the present situation. The policy heretefore outlined of constantly reducing prices was permissible as long as the cost price of material and labor did not advance more rapidly than the reduction in cost of manufacture and distribution, resulting from increased output and increased consumption per meter.

From government statistics it may be observed that the purchasing value of a dollar has been materially reduced during the past few years. All food stuffs, clothing, supplies, rents, in fact everything that we need and use, except gas and electricity, command higher prices than ever before known. And why should the gas man or electric man be prohibited from obtaining the full measure of profit demanded and obtained by the merchant and the artizan? The only answer to this question lies possibly in the fact that the directors and managers of gas and electric companies throughout the United States, particularly on the Pacific Coast, have made every strenuous effort to reduce their costs of manufacture and distribution in order to try and meet or approximate the demands of a prejudiced public, who have been incited to demand unreasonable conditions from quasi-public corporations, conditions which could not be obtained from any other channel of trade, or which would not be conceded by the public as individuals in their particular line of business or vocation. In consequence the labor costs have been increasing constantly, so that now the gas maker receives more than twice the pay per hour that he obtained 10 years ago. This advance is not confined to the gas maker, but is equally applicable to all employees, from the man in the ditch to the highest grade of skilled labor.

In addition to this burden the cost of the necessary requisites for plant operation, and for plant construction and extension, has likewise increased in value throughout, demanding a larger amount of money from the companies for a given capacity output.

It is doubtful whether any member of this Association has been more earnest in his endeavors to reduce the selling price of gas and electricity in this territory than the writer, or who has urged more active canvassing for business in order to more nearly approach the point of saturation in the respective communities, thereby having a minimum cost for labor and material and a maximum output per meter; and yet I now feel that there is a limit beyond which it will be impossible for the various gas and electric companies to keep down their costs, owing to the constantly increasing value of material and labor—increasing in a greater and more rapid ratio than the reductions obtainable due to enlarged output.

When the time arrives it will be necessary for the management of the various companies to place their cases fairly and squarely before the people, so that they may appreciate and understand not only the necessities of that particular time, but also to fully appreciate the efforts which have constantly been made in the past to assist every householder in the economic utilization of gas by reductions in price and by proper education in its economical use.

It is becoming more and more apparent to the enlightened citizen in every community that the operation of public utilities is proving expensive and burdensome when undertaken by municipalities. Every competitive feature is removed and every incentive for decreased costs is eliminated, and it becomes a matter of importance only to the politician in being able to retain his favorites in their positions. It has also proven true that when municipalities control public utilities there is a constant clamoring for investment of additional moneys in order to serve portions of the territory with such utilities. These extensions and increases in plant are not economically considered or executed, and if all demands are met with the burdens of taxation are materially increased.

A disinterested investigation of the material facts, with relation to the operation of public utilities by municipalities, particularly in the line of the manufacture and distribution of gas and electricity, will more than bear out statements herein made. It is not a new subject, but one which has been thoroughly investigated by some of the brightest minds in this country and in Europe, and it is generally conceded that there is no hope at this time for the economical operation of municipal plants with the political conditions now prevailing in the United States.

Another very marked advance in the utilization of artificial gas for power purposes has been the complete and satisfactory demonstration and utilization of the large gas engines of the California Gas and Electric Corporation.

The location of this plant, known s the Martin Station, is well known to you all, and a visit will prove profoundly interesting. The engines now in operation are three in number, all of uniform size, and each producing hourly and daily a maximum of 3,200 kilowatt hours per hour for periods ranging from 10 to 24 hours as required. The full capacity of each of these engines will be 4,000 kw. hours per hour, when the necessary changes are made in the weight of flywheel and the nicer adjustments, which had to be worked out in this pioneer plant. The daily logs will be most interesting to you, as they chronicle the operative success more fully and more satisfactorily than words of mine can properly express. One of the most inspiring features of the plant is to see a large mass lying cold and inactive, when, with the opening of a valve, it assumes life, and within 60 seconds thereafter it is generating a full load and supplying service to the patrons of the company.

When the installation of these engines was first conceived the primary object was to have a prime generator that would, from cold and rest, become active immediately for the purpose of generating continuous service for street railway operation. By reason of certain conditions it was found advisable to operate these engines in parallel with the water power plants, and much concern was felt at the possible success of such parallel operation. Since January, 1907, these engines have been from day to day operated without any difficulty in parallel with all of the power plants for the corporation, and should their usefulness in connection with street railways ever be impaired by any reason, they would still be valuable adjuncts as auxiliary plants for the entire system. That was the principal feature which initially prompted the installation of these engines.

I regret that we have no paper at this meeting on the operation and efficiency of this plant, although data was being compiled for that purpose. The recording instruments used were found, however, to be in error, and the time element necessary for a correct report of the econo-

mies of the plant prevented the presentation of this much desired paper. I know that the officers of the California Gas and Electric Corporation will see that at our next annual meeting a paper will be presented giving all facts for the benefit of the gas fraternity.

In concluding the remarks on this subject it might be well to state, in a general way, that the operation of the gas engines is no less efficient than the operation of high grade, condensing, triple expansion engines.

While no exact data is obtainable at the present time regarding efficiencies, except from a technical engineering standpoint, the actual consumption of gas and the rated output of the generators have been practically determined, which gives a certainty to the above statement, and when the engines are able to develop full capacity, and when it will not be necessary to manufacture a quality of gas for general distribution to operate the engines with, much higher efficiencies may be looked for; and I confidently predict that, when that time arrives, the actual efficiency of the gas engines from an economical standpoint will far exceed that of the high grade, condensing, triple-expansion engines.

The many and varied uses to which gas has been applied in the last 3 years, notably in metallurgical and other manufacturing directions, indicates the point of the necessity for the education of engineers through a collegiate course on a broader scale than the mere practical experience now obtained by most of the superintendents in charge of plants in a proper direction of this very extensive use of our commodity.

During our proceedings we are to be favored with a number of very valuable papers which will command your attention, and I wish to request of all the members that they enter into the full spirit of this meeting in every way and join actively in the discussions of the subjects which will come before you. We are to have a paper under the title of "A Recent High Pressure Installation," by past-President E. C. Jones.

We have all had more or less trouble with sulphur in our oils, and you will undoubtedly be delighted to hear from Mr. P. W. Prutzman on that subject.

Our active member, Mr. Geo. S. Colquhoun, favors us with a paper on "Repairing the Cup of a Two-Lift, 500,000 Cubic Feet Gasholder."

Mr. Stephen A. Byrne knows that he has something of interest under the subject of "Practical Suggestions from a Practical Man."

I know that you will be pleased to listen to a paper by our worthy past-President and Secretary, Mr. John A. Britton, on the subject of "History of Hydro-electric and Gas Development in Central California." No other member is better qualified to enlighten you on this subject.

A very interesting paper will be read by Mr. L. H. Newbert, on "Comparative Economy in Operation of Small Motors, by Gas, Gasoline and Electricity." This is an ever present problem for the managers in all the companies, and the paper should elicit a very full and free discussion.

Mr. George C. Holberton submits an interesting paper entitled "One Year After." Mr. Holberton is always interesting and many valuable suggestions will be obtained.

We have a number of topics which have general and local interest, as well as the ever present "Wrinkles" so ably edited by Mr. Geo. S. Colquhoun, and "Experiences," which have been so thoroughly exploited by the Editor, Mr. R. P. Valentine, and the "Novelties" will be shown by Mr. George H. Hollidge.

It becomes my sad duty to report the death of one of our oldest members, not only of the Pacific Coast Gas Association but one of the oldest men identified with the gas business on the Pacific Coast. I refer to Mr. William G. Barrett, whom we have all loved and whose absence we deeply deplore. He was one of our charter members, as well as an honorary member of our Association; always kind, loving and cheerful in his relations to the gas fraternity. We cannot help looking backward to the time when we knew him in active life. His genial countenance and his strong personality were a great power for good with all of our members and those who came in contact with him.

For more than 40 years he was associated with the one large Company which supplied San Francisco with gas, and later with gas and electricity. His whole heart was practically wrapped up in the gas department; not only his whole heart, but even his worthy son was dedicated to the gas business, so that when he laid down his official burdens and was elected Secretary emeritus of the San Francisco Gas and Electric Company, in 1902, Mr. Charles L. Barrett succeeded his father to the same position.

His death occurred August 8, 1907, having lived to the ripe old age of more than 84 years. He was born in Chester, Vt., on December 12, 1822. The funeral services were held Sunday, August 11th. The Pacific Coast Gas Association was represented among the pallbearers at the funeral, and a floral tribute, in the form of the badge of the Association, accompanied his remains to the grave.

He was a man to whom we could always go for counsel and advice, and he was ever ready and willing to aid and assist the members of the gas fraternity in every way.

I recommend that a committee be appointed to draft suitable resolutions, have same engrossed upon the minutes of this Association and a copy engrossed and sent to the members of the family of our deceased member and frater.

In conclusion I wish to thank all of the members of the Pacific Coast Gas Association for their loyalty and zeal, and bespeak for my successor a continuance of that good fellowship which has marked our career ever since the first gathering, in the old office of the San Francisco Gas Light Company, on First street, July, 1893.

Lampblack.—A Composite Paper by Several Members.

[Prepared for the Fifteenth Meeting, Pacific Coast Gas Association.]

In the beginning of oil gas making the one residual product was given the name of "lampblack." The separation of this substance from gas by means of water, and the further separation of it from the water, became the *bête noir* of the oil gas man, but a longer acquaintance with it has brought out its true worth, and the day will come when the value of lampblack will be so great that it will compel cleanliness, which is now an almost unheard of thing in oil gas works.

The ancient methods employed for oil gas making did not produce lampblack, but the modern way of applying high temperatures to the decomposition of oil produces little or much lampblack, according to the degree of heat applied.

Lampblack is not made directly from oil. When oil is plunged into a chamber which is highly heated its most natural physical change is to become a vapor and at a higher temperature a gas, as in the distillation of oil at lower temperatures vapors alone are driven off. These vapors may subsequently be condensed back to liquids again. In the gas generator, however, it is different. Gas, as at first produced from oil, is too rich in heavy hydrocarbons and would not be a good merchantable product, but when passed through more heated brickwork, these unstable hydrocarbons are decomposed at the higher temperature into their components—hydrogen and carbon. The hydrogen goes forward as a diluent gas, while the carbon goes into the wash box as lampblack. The breaking down of the hydrocarbons is a complex study in chemistry, which would require a paper in itself to explain, but the foregoing simple facts will show the origin of lampblack.

It is obvious that a material separated from gas must exist in extremely fine particles, and the lampblack, as it is separated from the gas by water in the wash box, is a subtance consisting of particles finer than the diatoms of the microscopist. This substance should theoretically be pure carbon; but, with the impurities existing in the oil and the foreign matter in the water used for washing the gas, the lampblack of the gas works consists of 98.8 per cent. carbon and 1.2 per cent. of foreign matter, which we call ash, pure carbon when burned having no ash.

The construction of a self-cleaning wash box, which would remove nearly all of the lampblack, was an interesting study, and was finally perfected, its chief feature being to carry the water used for sealing and washing in pipes to the bottom of the wash box under considerable pressure, so that the water and lampblack are kept turbulent, and in this condition forced out of the wash box through an opening of circular shape, it being found that any level, sharp surface acted as a skimmer which partly cleansed the water from the lampblack, leaving the lampblack in the wash box. This calls for manual labor to remove it from the wash box, while if the lampblack is kept in suspension in the water, and forced out of the wash box in that condition, the water and lampblack pass together to what is known as a lampblack separator.

This is an arrangement of wooden or concrete tanks with partitions, and the application of the reverse of the wash box principle; that is to say, the partition should be as sharp and nearly level as possible, so that, as the water flows over the sharp edges of the partition, the lampblack is left behind.

In small gas works it is sometimes necessary to use filter boxes for

cleansing the water from every particle of lampblack. In some works straw is used in these filters, as it has been found that barley straw is best adapted to the purpose, for the reason it is finer and packs better when it becomes wet. In other separators screens of burlap are used. In these works the overflow water runs into the city sewers, and the cleansing of the water is so well done that there have been no complaints from it.

One small works drains its overflow water directly into a trout stream, and a fisherman reported that he found better fishing below the gas works than above it.

This lampblack may be taken up by conveyors and dumped automatically at a distance in convenient piles. After it has partially drained it still contains 50 or 55 per cent. of water, and, after having been exposed to the sun for a year, this lampblack will contain as much as 25 per cent. of water. This water content makes it a difficult problem to briquette lampblack, although in itself with the small amount of oil tar, which is intimately mixed with it, acting as a binder, it is an ideal briquetting substance.

A well ordered gas works should make enough lampblack, which, used as a boiler fuel, will produce enough steam for gas making and the operation of auxiliary apparatus, such as pumps, engines, etc. In small works the greatest care and attention are required to recover all of the lampblack in order to obtain enough for fuel for steam making, and it is also necessary to gather the oil tar from the scrubbers and mix it with the lampblack in order to obtain enough fuel.

One writer says that the steam equipment of his plant consists of a 7-horse power boiler operating a small engine attached to a No. 3 Sturtevant blower. Steam was used for gas making as well as for heating the oil. The lampblack produced was not sufficient fuel for the boiler, from 75 to 150 barrels of oil per week being required as additional boiler fuel.

In order to better the conditions of the plant, to the end that lampblack alone should be used for fuel for making steam, all the steam piping in the works was covered with insulating material, and an electric motor was substituted for the engine to run the blower. The smaller plants find that the quality of the oil materially affects the output of lampblack, and in one works it was interesting to note that the thick oil used, after a new set was installed, some of the oil being as low as 11° B., caused an accumulation of an over-supply of lampblack, so that some of it was sold as a fuel to outside purchasers.

The heat of the burning lampblack makes it very destructive to ordinary grate bars, and it was soon found that the only durable grates were ordinary round, wrought iron bars, arranged on corrugated bearers, so that the distance apart of the corrugations regulated the spacing of the grate bars. It has since been found that a round bar of say 1¼ inches diameter by 5 feet long, made of cast iron, is more durable and less expensive.

The ash pit should be water tight and kept full of water. In addition a perforated steam pipe should be run under the grate bars near the center bearing bar, using a small amount of steam to prevent the bars from getting too hot, and thus add to their life.

It is found that lampblack with 50 to 60 per cent. of moisture gives the best results with an ordinary stack draught. Dry lampblack, or that containing but 22 per cent. of moisture, does not burn as well, except when it is mixed with from 5 to 15 per cent. of oil tar, such as is obtained from oil gas. Forced draught can be used when the lampblack contains 50 per cent. of moisture, if a deep fire is carried. The fire should be cleaned 3 times every 24 hours.

The firing of a boiler with lampblack was at first difficult and unsatisfactory, but it was learned that the fuel should be fired just inside the firing doors of the furnace at the front of the grate and allowed to coke; when the furnace needs more firing, it is the custom to shove the coked lampblack back from the front of the furnace and supply its place with a fresh charge. This method seems to work admirably.

Before the last of the coal gas benches was dismantled an attempt was made to coke lampblack. It was found that there was not quite enough tar mixed with the lampblack to produce a hard coke, and the admixture of a small quantity of oil supplied this deficiency, so that at the end of 8 hours, in an old-fashioned gas retort, at a bright cherry red heat, a clean, hard coke was produced, which, as will be readily understood, was an ideal domestic fuel on account of the small quantity of ash present in it. When lampblack coke is placed in an open grate and ignited each piece of coke glows and remains in that condition until it is all consumed, there being so little ash in it, that the oxygen is not hindered from reaching the carbon surfaces of the coke.

This method of producing lampblack coke was slow and expensive, and a coke oven, consisting of 8 vertical, brick retorts, patterned after a German plan, was constructed. The furnace which heated these retorts was fired by oil, a small quantity of oil was mixed with the lampblack and together charged into the tops of the retorts, and the coke, after from 24 to 36 hours, was discharged by gravity from the bottom of the retorts. This method was also slow and expensive and required a great deal of labor for handling and mixing lampblack and quenching the coke, so that coke making from lampblack was abandoned.

The problem of briquetting this substance is fascinating, but extremely difficult. Probably no less than 10 different types of presses, vertical and horizontal, wheel and plunger, have been invented, any one of which would have been successful with fine coal, or other easily compressible substance, free from water; but the only briquetting press which has, up to the present time, given any degree of satisfaction is an ordinary heavy plunger press, built like a machine for punching iron. The plunger of this press meets a charge of lampblack from a hopper and compresses it into a long mould with a slight taper, and each stroke of the compressor forces out a briquette about 1½ inches long. This way of making briquettes is similar to the ordinary sausage machine. One of these presses is now in use at the Potrero gas works in San Francisco, and the product of it is used for water gas making in a double superheater water gas set, taking the place of anthracite coal. A further improvement in this press has been made, the new form being vertical instead of horizontal, and it is arranged with four plungers operated by one shaft, thus increasing the capacity of the machine and diminishing the cost of labor in operating it. Lampblack with from 20 to 25 per cent. of moisture is being used for water gas making at the Potrero plant, San Francisco. The process is the same as when anthracite coal is used, excepting that a very small amount of blast on the generator is required.

It requires 35 pounds of lampblack per 1,000 cubic feet of gas, using 5 gallons of heavy crude oil per 1,000. This produces a gas of 30-candle power, containing about 800 B.T.U. per cubic foot.

The following is a typical analysis of gas made in this manner:

Carbonic acid	7.0	volumes.
Illuminants	18.4	"
Oxygen	0.3	"
Carbonic oxide	11.3	"
Hydrogen	20.5	"
Marsh gas	34.7	"
Nitrogen	7.8	"
	100.0	
B.T.U.'s	850.0	
Specific gravity	.680	

Experiments have been made with lampblack briquettes in a water gas machine, but only for short periods, it being necessary to use lampblack from the pile as sufficient briquettes could not be obtained.

The indications of these experiments, however, are that lampblack briquettes will equal Welsh anthracite coal as a generator fuel. Without briquetting the lampblack the water gas generators produce half the amount of gas that was previously made with coal, but with briquettes the full capacity of the machines is obtained, as the use of briquettes permits the use of a higher blast pressure and more blue water gas is made. There is very little loss of lampblack in a water gas generator, as there are no clinkers, and less labor is required to clean the fire.

Comparative Economies in Operating Small Motors by Gas, Gasoline and Electricity.

[A paper prepared for the Fifteenth Meeting, Pacific Coast Gas Association, by MR. F. H. NEWBERT.]

As I believe the subject of my paper is quite important to you all, I have, therefore, endeavored to handle it in a general way, hoping to draw out a full and free discussion, to the end that many facts and figures may be contributed by the members of the Association from the results of their practical experience, of which the majority of you have had more than the writer.

The smaller gas and gasoline engines require a heat input of about 14,400 B.T.U.'s to develop a brake horse power of which 11,855 B.T.U.'s are consumed in cooling, friction, etc., only 2,545 being converted into useful work, which is a loss of 81 per cent. The electric motor requires an input of about 820 watts to develop a brake horse power of which only 74 are lost, or 10 per cent. In the larger units the re-

sults will be more favorable, the loss in the electric motor being only 5 per cent. and in the internal combustion motor about 75 per cent.

Large internal combustion engines are more efficient than small ones for the like reason that large steam engines are more efficient than small ones. The efficiency of a steam engine depends to a great extent on the condensation through the cylinder walls, as, with an increase in size, the power increases as the square of the diameter of the cylinder, while the condensation will only increase as the linear dimensions of the cylinder. It will be readily seen that, with large gas engines, the heat lost in the jacket water, which amounts to 50 per cent. in small engines, will be decreased in practically the ratio stated. The mechanical friction may also be said to depend upon the same ratios. As to which is the more efficient, gas or gasoline engines, depends wholly upon the value of the fuel used.

A test made on an Otto engine, using 650 B.T.U. gas, showed an efficiency of 2.4 per cent. in favor of gas, while the author of a standard work on oil engines writes as follows: "In trials of gasoline with gas engines of the same size and construction it has been found that the indicated horse power from gasoline is from 12 to 20 per cent. higher than from illuminating gas, when running at full load. This does not correspond with the assign d number of heat units per cubic foot of gasoline vapor and illuminating gas, for gasoline vapor has been credited with almost the same value in heat units with 16 candle power gas."

Makers of internal combustion motors almost invariably rate the fuel consumption too low, as practical use has demonstrated, the quantity of fuel required depending wholly upon its normal value. For gas engine work natural gas approaches the ideal, and in the Central States, where it can be obtained at a very low figure, furnishes perhaps the cheapest power to be had – water excepted.

The testing of the power of the electric motor is an easy matter, as suitable instruments have been perfected for the work and their application is comparatively simple.

There are various methods of testing the power of the internal combustion motor, but probably the simplest and most satisfactory is by its application to generate an electric current which, by proper arrangement of detail, allows the test to be continued for a length of time and makes it a perfectly reliable one. For this purpose the motor may be belted to a dynamo of the same or a little higher rating than that of the motor. A short wiring system, with a volt and ampere meter, or an indicating watt meter, and a sufficient number of lamps in circuit, will indicate the power generated in kilowatts, to which should be added the loss of efficiency in the dynamo.

The ability of the internal combustion motor to do a certain amount of work, on a certain fuel consumption, depends also to quite an extent on design and construction. Some makers guarantee as follows:

12,000 B.T.U. per B.H.P. when engine is operating at full load.
14,000 " " " " " " " " ¾ "
16,000 " " " " " " " " ½ "

A test shows the following results on several sizes of gas engines. Gas consumption at per cent. of full load:

	25.	50.	75.	100.
2-horse power using 560 B.T.U. gas ...	60.4	46.2	38.0	31.0
8- " " 560 " "	46.0	30.6	31.2	25.5
16- " " 560 " "	44.1	35.0	29.0	23.1
165- " " 597 " "	41.2	34.3	24.0	18.3
200- " " 1,000 " "	25.0	15.0	12.0	10.5

The 200-horse power engine used 10,500 B.T.U.'s at full load for each B.H.P. delivered, an efficiency of 24½ per cent.

The writer has had some difficulty in arriving at a basis for calculating comparative costs on account of the varying fuel consumption at different loads. The most favorable conditions have, therefore, been assumed; *i. e.*, full load. Since California gas runs as a rule not less than 600 B.T.U.'s per cubic foot, and a series of tests at a prominent technical college showed an average requirement of 1 pint of gasoline per B.H.P., and as it is known that 820 watts of electricity will develop a horse power, the above quantities have been taken for the purpose of general comparison:

14,400 B.T.U. ÷ 600 = 24 cubic feet gas per B.H.P.
= 1 pint 68 gasoline per B.H.P.
= 820 watts of electricity per B.H.P.

Therefore, gas at 75 cents per 1,000 cubic feet, gasoline at 18 cents, and electricity at 2.2 per kilowatt, will result in equal costs of a horse power per hour.

It is, therefore, evident that gas can compete with gasoline, as the expense of attendance, maintenance, etc., will be about equal. Neither gas nor gasoline, however, can compete with electric power at the extremely low price at which current is sold in quantity lots on the Pacific Coast to-day.

Great progress has been made during the past dozen years in gas engine construction and design, with the result that steam installations for the generation of electric current are steadily being replaced with the gas engine, which speaks well for the progress which has been made in mechanical engineering.

It might be interesting to some of you to know that the following results were obtained in one of the Central States where a steam plant and a gas engine plant were operated under like conditions:

The repairs on the gas engine installation during the year amounted to .00219 per kilowatt hour generated; the repairs on the steam plant during the same period amounted to .004451 per kilowatt hour generated; the cost of fuel for the gas engine plant per kilowatt hour was .679 of the cost of fuel per kilowatt hour with steam.

At Bradford, Pa., an electric light and power company converted its steam plant into a gas engine plant, using natural gas at 10 cents per 1,000 cubic feet. The steam plant burned natural gas under the boilers and required 51 cubic feet per indicated horse power, or about 86 feet per kilowatt. Observation upon the gas engine plant showed an average consumption of 21.5 cubic feet of gas per kilowatt for all loads and conditions of operation. The totat cost of operating the steam plant of 500-horse power was about $20,000, whereas the gas engine plant, of 800-horse power, was operated at a total cost of $12,000.

The cost of installing a gas engine plant has been found to be from 25 to 30 per cent. greater than for a steam plant. However, the economy of the former has been clearly demonstrated by its extended use in Europe and in this country, and indicates that the difficulties formerly considered insurmountable have now been fairly overcome, and that the large gas engine, for certain lines of work, can no longer be dismissed from consideration.

Historical Data—Gas and Electricity.

[Compiled for the Fifteenth Meeting, Pacific Coast Gas Association.]

Gas.– Gas or *gaz*, derivation from *gischt*, the old German for *geist*, a "spirit." The honor and merit of the discovery and practical application of coal gas are due to William Murdoch, who began his experiments in 1872. In 1797 lighted his premises at Old Cummock, Scotland, with coal gas, and in 1798 the Soho Foundry, Birmingham, England, was lighted by gas.

The first public street lighting with gas took place in Pall Mall, London, on January 28th, 1807. This was due to the energy of Mr. F. A. Winsor.

The wet gas meter was invented by Clegg in 1815, and in 1820 the first dry gas meter was patented by Malam.

In 1825 Cornelius Whitehouse obtained a patent for improvements in manufacturing iron pipe for conveying gas. Wrought iron pipes were first produced at a moderate price by means of this discovery. These pipes were known by the name of "gun barrel," a name derived from the kind of pipe they had superseded.

In 1825, the dry gas governor was invented by Samuel Crossley.

In 1830 Michael Donovan obtained a patent for a method of increasing the illuminating power of gas by enriching,

The dates of incorporation of the principal Metropolitan Gas Companies are: 1810, Chartered Company; 1817, City of London Company; 1821, the Imperial Company.

In 1833 the telescopic gasholder was invented and patented by Hutchinson.

Gas purification with oxide of iron was first recommended by Croll, in 1840, who obtained a patent during the year.

In 1841 the gas exhauster was invented by John Grafton.

Clay retorts were first manufactured in Scotland, in 1816; while the first important use of clay retorts in England was at the "Brick Lane" Station of the Chartered Company, in 1844.

In 1825 benzole was discovered by Faraday, and in 1826 aniline was discovered by Unverderben.

In February, 1849, the London *Journal of Gas Lighting* was established.

In 1852 *Le Journal de l'Eclairage au Gaz* was published in Paris, and in 1857 a second French periodical, *Le Gaz*, was established.

In 1858 the *Journal für Gasbeleuchtung* was started in Munich; and in 1859 the AMERICAN GAS LIGHT JOURNAL made its appearance in New York.

In February, 1873, Prof. T. S. C. Lowe discovered the application

of secondary combustion to water gas making, and started the first water gas works in the world at Phœnixville, Pa.

In 1884 the first high pressure gas distribution system was installed in Oakland, Cal., by the Oakland Gas Light and Heat Company.

The incandescent gas mantle, which made possible the Welsbach burner and the broad range of incandescent lighting, was invented by Dr. Carl Auer von Welsbach in 1885 and 1886.

The first crude oil water gas was made by L. P. Lowe, in Los Angeles, Cal., in 1889. In the early part of the same year a crude oil water gas plant was erected in Lynn, Mass., but was never started.

The first crude oil water gas patent was issued to Mr. L. P. Lowe, in 1889.

The Pacific Coast Gas Association was organized in San Francisco, Cal., July 11, 1893.

In 1879 the Jones jet photometer, by E. C. Jones.

Robert Wilhelm Bunsen was born in Gottingen, Germany, 1811, and died in Heidelberg, in 1889. Professor Bunsen was regarded as the most brilliant scientific figure in the Nineteenth Century. His invention of the Bunsen burner, designed to produce perfect combustion and obtain the maximum heat value of the gas, made possible the incandescent gas light, invented by Dr. Auer von Welsbach.

Electricity.—Faraday made his discovery of the magnetic induction principle in 1831. Shortly after Faraday's discovery machines on this principle were devised by Dal Negro and by Pixii. In 1832 Pixii made a second machine, supplying it with a commutator for rectifying the alternating currents. The above machines used permanent magnets to supply the magnetic fields.

Electro instead of permanent magnets were first patented by Wheatstone, in 1845. In 1867, Dr. W. Siemens brought out a self-excited, D. C. generator, driven by mechanical power, and to describe it coined the phrase, "Dynamo-electric machine."

The first constant current open coil machines were brought out in 1880, by Thomson & Houston, but it is stated that the first successful machine was operated in Philadelphia some months earlier than this. The earliest record of use of a single phase alternator is a machine designed by Nollet Holmes and others in France, and used successfully, from 1863, in the lighthouses of that country.

The first polyphase alternator did not come into general use until after 1890.

Edison's first successful incandescent lamp was completed in 1879.

The discovery of the electric arc is accredited to Sir Humphrey Davy a little over a century ago. It was not brought into practical use for lighting, however, until after the introduction of the dynamo.

Faraday made the first transformer in connection with his early experiments. The magnetic circuit of this transformer was a closed ring of iron. Following transformers used straight iron cores, until Varley, in 1856, pointed out the advantage of using a closed magnetic circuit. This gave rise to the shell type transformer, which was used until the General Electric Company brought out the "Type H.," core type transformer in 1895.

The first series incandescent system was installed by Mr. H. H. Cutler, in Watertown, Mass., about 1886. These lamps were used in series in a special socket direct across a 100-volt alternator.

History of Hydro-Electric and Gas Development in Central California.

[A paper read by Mr. John A. Britton, at the Fifteenth Meeting, Pacific Coast Gas Association.]

When on Admission Day, September 9th, 1895, the Folsom Water Power Company completed its transmission line of 11,000 volts, from Folsom to Sacramento, begun 5 years previously, the completion of the enterprise was held by the world as the final consummation of the utilization of the immense power contained in the Sierran waters. This installation called for 3,000-horse power, generated at 800 volts, transformed to 11,000 volts and sent over 22 miles of copper wire to supply the city of Sacramento with electric energy for its street railway system, and for lighting and incidental power.

Prior to this time there had been installed a hydro-electric plant on the European Continent, rather in the nature of an experiment, but proving subsequently practical, and known as the Frankfort-Lauffen transmission of 81 miles. This was built and operated as a polyphase system in 1891, and was an actual forerunner of the developments subsequently to be made not only on the Continent of Europe but in America. In the year 1892, the San Antonio Light and Power Company built and operated what was known as the Pomona plant, in Southern California, with a transmission of 30 miles, operating under 10,000 volts. The first polyphase plant to be built in California was that from Mill Creek to Redlands, in 1893, and operating under 2,500 volts.

While these so-called gigantic works were in process of construction, certain of the water rights on the northern rivers in California had been taken up by intrepid pioneers, with the distant thought that some day the hopes of the utilization of water other than for past purposes of mining, might be realized. Among these pioneers was Mr. A. A. Tregido, who, in the winter of 1891-92, located a water right on the South Yuba river. He later enlisted the services of Mr. Eugene J. de Sabla, Jr., of San Francisco, through the efforts of whom, coupled with the energetic association of Mr. John Martin, was made possible the commencement of a plant, in July, 1895, on the South Yuba river, known as Rome Power House, for the purpose of supplying Nevada City and Grass Valley and the adjacent mines with light and power, and in February, 1896, the system was completed and put into operation.

This was the beginning of the California Gas and Electric Corporation which now consists of the following companies:

Power Divisions.—Bay Counties Power Co.; Valley Counties Power Co.; Standard Electric Co., of California; Yuba Electric Power Co.; Nevada County Electric Power Co.; Butte County Electric Power and Light Co.; Central California Electric Co.; San Mateo Power Co.

Water Divisions.—Blue Lakes Water Co.; South Yuba Water Co.; Stockton Water Co.

Distributing Divisions.—Oakland Gas, Light and Heat Co.; Sacramento Electric, Gas and Railway Co.; United Gas and Electric Co.; Berkeley Electric Lighting Co.; Fresno Gas and Electric Light Co.; Vallejo Gas Co.; Chico Gas and Electric Co.; Colusa Gas and Electric Co.; Marysville Gas and Electric Co.; Napa Gas and Electric Co.; Nevada County Gas and Electric Co.; Petaluma Gas and Electric Co.; San Rafael Gas and Electric Light Co.; Santa Rosa Lighting Co.; Woodland Gas and Electric Co.

The above systems of the California Gas and Electric Corporation operate in the following 22 counties: Butte, Colusa, Sutter, Yuba, Nevada, Placer, Yolo, Sacramento, Amador, Napa, Sonoma, Marin, Contra Costa, Alameda, San Francisco, San Mateo, Santa Clara, San Joaquin, Solano, Calaveras, Tuolumne and Fresno, supplying in these several counties 109 cities, towns and settlements. The territory in which the transmission lines of the Company operate comprises 15,000 square miles, supplying two-thirds of the entire population of the State of California.

Following the completion of the Folsom plant, the Blue Lakes Water Company, in 1896, commenced the installation of an hydro-electric plant in connection with its water systems, then supplying mines on the Mother Lode, water power for mining purposes, and in 1897 installed on the Mokelume river, just above the main bridge crossing said river, between Mokelume Hill and Jackson. This plant contained three 600-horse power generators, operating under 1,040-foot head. Two transmission lines, operated at 18,000 volts, supplied the southern mines in Amador county and an extension of the Mother Lode in Calaveras county, while an additional transmission line, carrying 30,000 volts, supplied energy to the Stockton Gas and Electric Company, in the city of Stockton, for light and power. The promoters, realizing the large demand which would follow the installation of an electric transmission line towards bay points, determined upon the enlargement of the original Blue Lakes plant, so called, and incorporated what is now known as the Standard Electric Company of California, and commenced the erection of an entirely new plant, at a point on the river about 4 miles north of the original installation, which was known as the Electra power house. On November 1st, 1899, prior to the completion of the new installation, the old plant was destroyed by fire. It was, however, rehabilitated and operated during the construction of the new plant, and upon the completion of the Electra installation the old plant was and ever since has been abandoned.

The first installation in the new plant was five 2,666-horse power generators. The power house was supplied from "Lake Tabeaud," an artificial reservoir having a storage of 50,000,000 cubic feet, at the end of the Standard and Amador Canals, by two pipe lines 3,278 feet in length, with a head of 1,466 or 1,266 feet, as desired, feeding directly on high head from the Standard Canal through its penstock, the Petty Reservoir, or, on the low head, from Lake Tabeaud, into which the Amador Canal emptied. A tunnel from "Tabeaud" and wooden stave pipe from "Petty" load to the manifold where change from high to low head was made at the head of the main pipe lines.

The main storage reservoirs of the Blue Lakes Water Company, supplying the power house above mentioned, and previously used by

the Blue Lakes Water Company, are what are known as the Blue Lakes, in Alpine county, which were subsequently increased by the creation of two artificial reservoirs—one known as Twin Lakes and the other as Meadow Lake. These have an aggregate capacity of approximately 1,000,000,000 cubic feet and are called upon only after the Mokelume river, on which the head dams of the Company are situated, fall below the requirements of the power house. The water from these lakes flows through a natural watercourse to the head dams on the Mokelume river where the Amador and Standard Canals, 42½ miles distant from the Blue Lakes, convey, by ditches and flumes, the water to Lake Tabeaud. These canals are 18.6 miles in length, from the head dams on the Mokelume river to the manifold.

When the property of the Standard was acquired by the Corporation the Electra power house was extended and two additional units of 6,666-horse power capacity each placed, together with an additional pipe line, which is also susceptible of being operated under a high or low head, as before stated. This made a total capacity in generators in the power house of 26,666-horse power. It is interesting to note that in the development of the large units, both in generators and in water wheels, for hydro-electric purposes, the 13,333-horse power last installed at Electra occupy a floor space of a little less than one-half of the space required for the previous installation of 13,333-horse power.

As heretofore noted, the practical inception and birth of the Corporation work were in the development of the waters of the South Fork of the Yuba river and the completion of what was known as the Rome Power House, in February, 1896, for the supplying of current to the cities of Nevada and Grass Valley, for power and lighting purposes. In the development of this branch of the South Yuba the attention of the promoters was directed to the possibilities of water development on the middle fork of the Yuba river, where a dam had been built, and water carried by flumes and ditches into what is known as Brown's Valley, for irrigation purposes, and there was erected in April, 1898, at the head of Brown's Valley, by what was then known as the Yuba Power Company, a power house having a capacity of 1,220-horse power, operated by a pipe line 850 feet in length and under 292 feet head, feeding a power line at 16,500 volts, supplying, primarily, the town of Marysville, this line being approximately 23 miles in length. This was a record breaking installation, as the entire work was finished and the plant in operation within 4 months and 5 days after its building had been determined upon. Immediately thereafter, and at a poimt on the river known as Missouri Bar, the Colgate Power House of the Yuba Power Company was commenced, under contract to deliver power into Sacramento.

This herculean task was accomplished and the first installation, in 1899, consisted of three 1,200-horse power generators, operating under 40,000 volts. A transmission line, 76.3 miles in length, was built to the city of Sacramento, at that time the longest transmission in the world, and on September 5, 1899, the current was supplied to the system of the Sacramento Electric, Gas and Railway Company, and operated in parallel with the steam plant in Sacramento and the hydro-electric plant at Folsom. In addition thereto a line was operated from Colgate to the dredgers on the Feather river, at Oroville, and one to the Rome Power House, and for the latter purpose there was installed in the Colgate Power House one generator of 960-horse power, operating at 133 cycles, that being the periodicity of service at the Rome Power House. Subsequently, the 40,000-volt line was extended and operated in that same district from Colgate. The capacity within the next 2 years of the Colgate plant was increased by an additional building and the installation of three 2,666-horse power generators and at the present time one 6,333-horse power is being installed.

Colgate obtains its supply from a flume which was built immediately over the then existing Irrigation District flume. It has a capacity of 15,000 cubic feet per minute and is 7.6 miles in length. As a safeguard and for storage purposes, water for the Colgate plant is stored in an artificial lake, known as "Lake Frances," at the head of Dobbins Creek, just above the power house. This lake has a capacity of 110,000,000 cubic feet, and by means of a rapid flume, 8,500 feet in length, under 300 feet head, feeds into the penstock at head of pipe line. There are 5 pipe lines operated from the penstock to the power house, each 1,625 feet in length, under 700 feet vertical head, pipe being of steel and cast iron, 30 inches in diameter.

There are six transmission lines operated from Colgate, two operating to Oakland where the system is tied in with the Standard—one line operating from Colgate direct to Sacramento, as before stated, one operating to and taking care of the dredger load on the Yuba river, near Marysville, this being in fact a continuation and enlargement of the original line from the Yuba Power House to Marysville, formerly mentioned, one to the Dredger District at and near Oroville, on the Feather river, tying in at that point with De Sabla, and two lines, one of 60 cycles and one of 133 cycles to Rome Power House.

April 27, 1901, will always be regarded as a red letter day in the history of the corporation, for on that day the consummation of the most sanguine expectations of the promoters of the enterprise was achieved. The Bay Counties Power Company, from its Colgate plant, transmitted by twin lines electric power to the city of Oakland, in Alameda county, over mountain, hill, valley, river and forest, a distance in all of 140 miles; and at a signal from the engineers, the switch was closed and power from the eternal snows was transmitted to motor generator sets, supplying current for the street railway systems in Oakland. Despite the significance of the event, and the wonderful effect it has had upon the community, it was but modestly observed and mentioned by the officials of the corporation.

The public will without doubt regard the great span of wire across the Strait of Carquinez as being the most spectacular feature of the entire system of the Bay Counties Power Company, and indeed the building of this enormous span has truly constituted a wonderful achievement. Although cables for telephone and telegraph service have been laid under the straits for many years it was by no means possible to lay electric power cables there for many most valid commercial and technical reasons. The rivers of the great valleys of Central California—even its entire portion between the Siskiyous and the Tehachapis—find their way to the ocean through the Straits of Carquinez, where the tide runs deep and swift and where the cables are subjected to wear that would soon bring ruination to any that might carry electric power service at very high pressure. To carry the lines overhead, therefore, was the only alternative, and the fact that there was no engineering precedent for the work proved to be no deterrent, for in truth it can be said that the system of the Bay Counties Power Company from its inception to its completion is one that has been executed without relying upon precedent as paving the way for the accomplishment of the object to be attained. Nor is it believed that anywhere in the world but in the West is there to be found the rare combination of courage of conviction, united with the daring yet prudent capital so necessary to prove an enterprise to be independent as to precedents and resourceful as to expedients.

Until the spring of 1901 the longest span in any electric power transmission line operating on the North American continent was that of the West Kootenay Power and Light Company, Ltd., of Rosaland, B. C., which reached across the Columbia river in a sheer stretch of 1,500 feet. This installation has been described in the technical press heretofore, hence any special reference to it at this time is unnecessary; but suffice it to state that the span consists of bimetallic wire supported on reinforced rows of Redlands type, high tension, porcelain insulators. Exigencies that have arisen in the purpose of the Bay Counties Power Company, of San Francisco, to reach the market for power found in the cities about the Bay of San Francisco, made it necessary that the transmission lines should span the Straits of Carquinez. This has now been done with the most gratifying success and the result is that the Bay Counties Company is now operating its entire load in the counties of Contra Costa, Alameda and Santa Clara over cables that are in excess of a mile in length and which cover the horizontal distance of 4,427 feet in a single span that has a clearance of 206 feet above extreme high tide.

The Strait of Carquinez is a comparatively narrow water-way separating Solano and Contra Costa counties, of California, and connecting San Pablo and Suisun Bays, which together form the northerly extremity of San Francisco Bay. A glance at the map will show the situation clearly, and also show the fact that practically the entire central portion of the State of California from the Siskiyous on the Oregon boundary to the Tehachapis which mark the dividing line between the portions of the State vaguely defined as Central and Southern California, on the south, is drained into the ocean through either the Sacramento or the San Joaquin rivers into Suisun Bay, thence through the Straits of Carquinez and on to San Pablo Bay to the broad Pacific. At the point selected for the crossing the water is about 2,750 feet wide with a depth ranging up to 120 feet, and through this narrow gap flow the waters of the rivers named as well as an ocean tide of about 5 feet, making at all times a heavy and dangerous current, which, though not so strong as to prevent the laying and operation of telegraph and telephone cables, is sufficiently so that it makes their maintenance a serious item and utterly precludes any possibility of laying and operating high tension power submarine

cables. Of course, the laying of such cables was considered very carefully, but the strength of the current in the channel, together with the rocky character of its bottom, and the impossibility of constructing heavy high tension cables that would operate at 60,000 volts and give assurance of withstanding the abrasion of the channel, soon led to the conviction that the only possibility of crossing the straits was to be found in the aerial method.

To meet all requirements it was finally decided to erect a tower 225 feet in height at a suitable position on Dillon's Point, and another steel tower, 64 feet high, back of Eckley, on the south side at the 400-foot elevation referred to. These two towers are known as the north and south towers respectively, and the horizontal distance between their perpendiculars is 4,427 feet. It must be borne in mind, in endeavoring to understand the reasons which led to the adoption of the plan followed in erecting the span, that a minimum clearance of 200 feet had to be provided above the surface of the water; hence, in order to limit the height of the main tower to 225 feet, as was advisable, it was decided to so locate the south tower on the hill side that its top should be 80 feet higher than the top of the main tower, thus throwing the lowest point of sag in the span in the lineal center between the two towers; in fact, this lowest point is 2,455 feet from the south tower. A further reason for the arrangement adopted is found in the fact that the land north of the main tower falls away to a marsh at near tide level, which made it necessary to turn the cables down to anchorages some 1,700 feet back of the main tower. This condition compelled a great change in the dip of the cables between the main tower and the north anchorages, and necessitated the erection of the third or north tower, which, because of this change in the direction of the cables, was built to lean toward the north. Its inclination is at an angle of 13° from the perpendicular, and this has led to its being known as the "leaning" tower, although the Company terms it the "north" tower.

Owing to the high lands on both sides of the straits the span appears to approach the water much closer than it really does and the optical illusion is at all times most perplexing to mariners who first take their ships under the crossing. The story is told that while a a big wheat freighter was being towed up to Port Costa early in April just after the second cable had been raised, her master and the captain of the tug were startled, as they neared Crockett, at observing two heavy wires spanning the straits and seeming to drop so low as to threaten destruction to the masts of the ship. The vessel's headway was checked and observations were taken, after which the tug and its tow moved forward very slowly and sought a passageway near the northern side of the straits, where the wires were highest above the water. The ships masts were 150 feet tall and when they passed under the wires they lacked another 150 feet of touching, although the captain had rather expected that his topmasts would come tumbling down, and the commander of the tug, who was giving an excursion to several ladies from San Francisco, sent them all down into the cabin to save them from being killed by the threatened falling spars and ship's rigging.

After this great result had been achieved, the increased demand for power made the possibilities of the development of power upon Butte creek, in Butte county, attractive to the pioneers of the Bay Counties Power Company. A small plant had been operated for some time by the Butte County Electric Light and Power Company, at or near John Adams Post Office, commonly known as the Centerville Power House. The Valley Counties Power Company was incorporated in 1900, financed, purchased the plant at Ceterville and proceeded with the erection of what is commonly known as the De Sabla Power House, on Butte Creek, utilizing the waters of the west branch of the Feather river, and that of Butte creek, through the Butte, Toadtown and Inskip miner's ditches. It is also the owner of extensive water rights on French creek, in Butte county, which are now in process of development for additional power plants.

From the De Sabla plant, and in connection with the Centerville plant, a high tension line is operated through Butte and Yuba counties, connecting with the transmission line from the Colgate Power House, at Oroville, and another branch operating to Chico and Colusa, thence on through Gridley to Marysville and Nicolaus, where it is again tied into the Bay Counties' twin line.

Coincident with this construction the Central California Electric Company, a subsidiary company of the South Yuba Water Company, primarily organized and operated for the purpose of supplying water for power or mining purposes, built two small hydro-electric plants at Auburn and Newcastle, along the lower lines of the ditches of the South Yuba Water Company, their construction having been commenced in the year 1895. Subsequently, in 1900, and coincident with the building of the De Sabla plant, a power house was built at Alta. The first transmission line from Auburn and Newcastle was operated at 15,000 volts and upon the completion of the Alta plant this potential was increased to 30,000. From time to time the several main transmission lines were changed in potential to 60,000, until to-day all are so operated.

Mr. John Martin, one of the original pioneers of water power development, determined for the economical distribution of both gas and electricity throughout the territory then controlled by the Bay Counties Power Company, that it would be advisable to purchase the several smaller companies operating along said lines. He therefore organized the California Central Gas and Electric Company and purchased the operating companies in the cities of Nevada City, Grass Valley, Marysville, Woodland, Chico, Colusa, Napa, Petaluma, Santa Rosa and San Rafael, all of which were subsequently merged, with other various distributing lines, with the corporation.

Prior to the formation of the corporation, the gas plant at Fresno was purchased, as was also the entire plant, both gas and electric, and the street railway system of the Sacramento Electric, Gas and Railway Company, and upon the formation of the Corporation the Oakland Gas Light and Heat Company, with its dependent companies, the Berkeley Electric Lighting Company and the Alameda Gas Company, were purchased, and subsequently the Vallejo Gas Company became a part of the corporation.

At the time the corporation purchased the Standard Electric Company of California it also purchased the properties of the United Gas and Electric Company, operating all of the cities and towns on the San Francisco peninsula, between San Jose and the corporate limits of the city and county of San Francisco.

All of the cities and towns mentioned are connected with the transmission lines of the corporation, the entire system of power houses, located at Electra, Sacramento, Auburn, Rome, Alta, Newcastle, Colgate, Yuba, De Sabla and Centerville, being operated in parallel, and feeding the power required into its system.

With the growth of the power companies, grew also in proportion the development of industries along the line of the corporation; from a small beginning of 880-horse power, developed by water at the Rome Power House, has sprung into existence a system operating today over 90,000-horse power.

Connected with Oakland, San Francisco and San Jose are steam plants, feeding in also to the entire system.

(To be Continued.)

Studies in the Manufacture of Coal Gas.

[A paper prepared for the Fifteenth Meeting of the Michigan Gas Association, by PROF. ALFRED H. WHITE and MR. FRED. E. PARK.[1]]

Introduction; Description of Experimental Plant; Operation of Experimental Plant; Influence of Size of Charge on Products of Destructive Distillation; Products of Distillation in Successive Half-Hour Intervals; Work of the Condenser; Work of the P. & A. Tar Separator; the Elimination of Naphthaline; Work of the Tar Washer and the Scrubber. Summary.

The present paper is the seventh to be presented to the Michigan Gas Association as the result of your support of a Fellowship in Gas Engineering at the University of Michigan. At your last annual meeting it was voted to erect an experimental plant in connection with the works of the Ann Arbor Gas Company, where the factors influencing gas manufacture and purification might be more closely controlled and better studied than had been possible in tests made on full-sized plants.

Your committee having charge of the matter decided that the plant should consist of a complete condensing and purifying plant designed small enough to be suitable for the investigation of the products from a single retort. It was hoped at the time that it could be equipped within a few weeks, but the manufacture of the special apparatus went slowly, and it was not till April 27th that the completed plant was ready. This paper is in the nature of a preliminary report of its operation.

It is customary to preface such a report with a review of what has been done by previous experimentors. The most conspicuous example of previous work of this sort on American coals is found in the admirable paper read before your Association 3 years ago by your

1. Holder of the Michigan Gas Association Fellowship in Gas Engineering at the University of Michigan, for 1906-7.

present President.[1] There is more literature available on the subject of the treatment of European coals, but most of the tests that have been made have been conducted with the purpose of testing the coal for its gas making qualities under given conditions of manufacture, rather than testing the effect of variations in the process of manufacture as the principal object of the investigation. The literature is at best conflicting, and we have deemed it wiser to omit altogether a review of it in this paper.

Description of the Experimental Plant. The condensing and purifying apparatus is installed in an annex to the retort house of the Ann Arbor Gas Company. A plan of it also of a portion of the adjacent retort house is shown in Plate I., while the general appearance

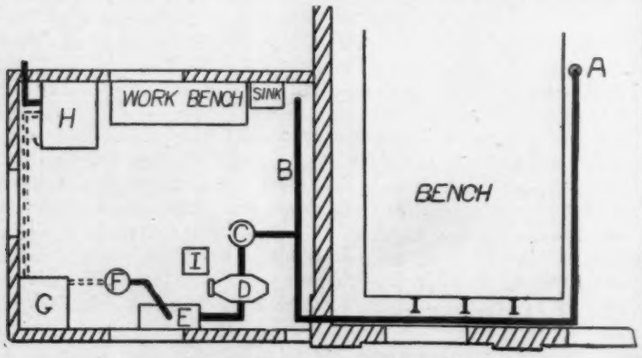

Plate I.—Plan of Experimental Plant.

A, Standpipe; *B*, Condenser; *C*, P. & A. Tar Separator; *D*, Exhauster; *E*, Tar Washer; *F*, Scrubber; *G*, Purifier; *H*, Meter; *I*, Engine.

of the apparatus is shown by the photograph of Plate II. The gas is

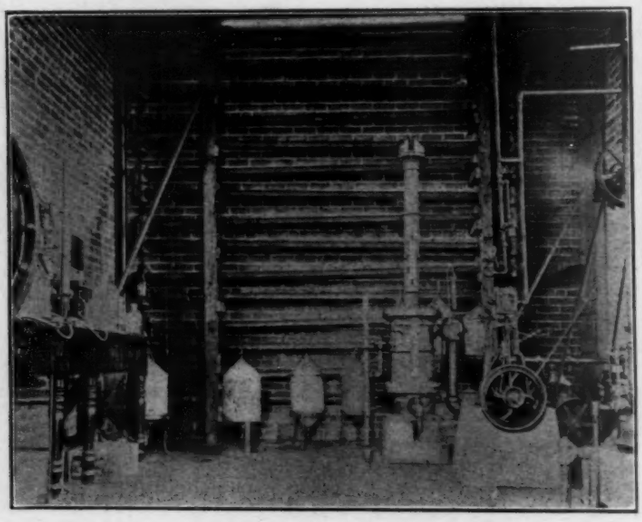

Plate II.—View in Experimental Plant.

taken from a single retort which has been the same one during the tests reported here. It is a ⏢-shaped retort, 26 by 16 inches by 9 feet, and is one of the upper retorts of a modern bench of sixes with ¾ depth regenerative settings. It was selected because of its convenience of location, but it happens to be one of the hottest retorts in the house. The retort is in regular use by the Gas Company. When it is to be nsed for experimental purposes the cap is removed from the top of the bridge pipe and a 4-inch pipe clamped and luted on in its place. This pipe leads with a run of 32 feet of 4-inch pipe to the condenser in the annex where the experimental apparatus is located.

It was desired to make this condenser as flexible as possible so that the condensing surface could be diminished or increased as desired, and so that the changes taking place during the cooling of the gas could be studied. It was, therefore, built up from pieces of 3-inch pipe coupled together into a zigzag, the gas entering at the top and working back and forth through almost horizontal pipes until it reaches the bottom. Plate III. gives a detail of the condenser showing how the temperatures are taken and how the products condensed are drawn

1. "Temperature as Applied to the Production and Purification of Coal Gas," by V. F. Dewey, "Proceedings Michigan Gas Association, 1904." AMERICAN GAS LIGHT JOURNAL, Oct. 10, 1904, p. 563.

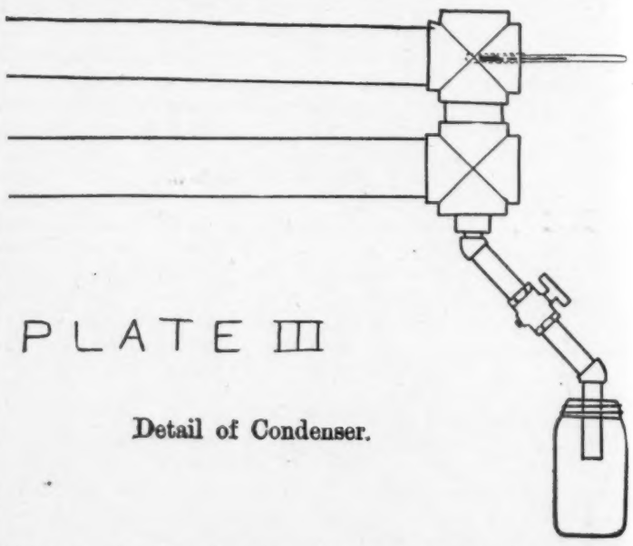

PLATE III

Detail of Condenser.

off into glass fruit jars for measurement and examination. Following the condenser is a P. & A. tar separator from the Lloyd Construction Company. The gas then goes to a small Root exhauster, which was placed *after* the separator so as to avoid the complication of having to consider the action of the exhauster as a tar remover in addition to its regular function. A tar washer from the Gas Machinery Company is the next piece of apparatus. It is followed by a tower scrubber made from a piece of 16-inch water pipe filled with coke and provided with a water spray. A purifying box, 3 feet square, from the Kerr Murray Company, followed by a 3-foot station meter, completes the equipment.

This equipment, with a few additions which we hope to make later, makes possible a study of the process of destructive distillation from its commencement to its close with a simultaneous examination of the processes of condensation and purification.

Operation of the Experimental Plant.—It seemed best, at the commencement of the work at least, to confine the test to observations of a single 4-hour charge, making all the observations which seemed of possible value and for which equipment was at hand. A test of this sort is always interesting to University students and there is no trouble in getting any desired number of helpers. There have been 10 men usually employed on the tests so far made. Unfortunately after each test must come a very large amount of routine analytical work in the laboratory, which falls on the one or two people especially interested, so that it has taken nearly a month to complete the analyses of one test. We desire to express our indebtedness to Mr. J. H. Wyman and Mr. A. J. Hall for their services in this connection.

The method of operating the plant was in general the same in all cases and as follows: The charging of the retort was done by the regular retort house crew in their usual manner. In the interval between the drawing of the old charge and putting in the new the cap on top of the bridge pipe was swung back and the pipe connecting to the experimental plant swung in and bolted down. The experimental exhauster had already been running for about 15 minutes pulling air and steam from a special line through the condenser to preheat it to what would be about a normal working temperature. Just before the retort was charged this steam was cut off and the drips on the condenser opened to let out the condensed steam. The glass fruit jars were then screwed on the drips to catch the liquid as it condensed, and at the signal from the retort house the first meter reading was taken and the test was started. During the test readings were made every 5 minutes of the temperature and pressure at the top of the standpipe, of the temperature at the inlet to the condenser, the temperature at the inlet to the P. & A. separator, and the differential pressures on the P. & A. and washer. In addition the readings of the meter, and the temperature of the gas leaving the meter and the room temperature, were observed at the same intervals. Every ½ hour during the first 2 hours of the run and every hour during the last 2 hours fruit jars on the condenser drips were all changed and the tar drawn off from the P. & A. These samples were all saved for later examination. As nearly as might be during the same periods tests were made at the inlet and outlet of the P. & A. and inlet to the meter to determine the suspended tar and naphthaline in the gas at these points. Tests were also made for ammonia in the gas at the inlet to the P. & A. At approximately

the same intervals gas analyses also were made from the inlet to the meter. These analyses were made on the spot to prevent condensation of hydrocarbons, possible if the gas had been transferred to the laboratory, but the confusion and rather crowded quarters did not conduce to the greatest accuracy and the results were not altogether satisfactory. Lach of equipment prevented measurement of candle power of the gas. Lack of an electric pyrometer also prevented the continuous measurement of temperatures inside of the retort, but the temperature of the retort was measured by an optical pyrometer after the coke had been drawn, this single determination being the only one made.

In all 6 tests have been made in this manner although the first 3 were preliminary and incomplete. Tests 4, 5 and 6 are available for presentation, but it has seemed best to present only tests 5 and 6, which were made with coal from an identical lot and with a retort temperature nearly the same in both cases. The variation in the 2 tests lies in weight of coal charged, test 5 being made on a heavy charge and test 6 on a light one. These 2 tests will give an idea of the scope of the experiments and also of the differences which may be caused by alteration in the weight of coal charged.

Influence of Size of Charge on Products of Destructive Distillation.—Tests 5 and 6 were made with coal from one lot of Youghiogheny ¾ lump whose proximate composition was as follows:

Moisture	1.26 per cent.
Volatile combustible	34.78 "
Fixed carbon	57.22 "
Ash	6.24 "
	99.90 "

The charge in test 5 was 470 pounds and in test 6 only 350. Both charges were drawn after they had been 4 hours in the retort, although the heavy charge was incompletely carbonized. The coke flamed as it was drawn from the retort and the rate of evolution of gas had hardly commenced to slacken at the end of the period. The following table gives the weights and percentages of the various products of destructive distillation:

TABLE I.—*Products of Destructive Distillation.*

	Test 5.		Test 6.	
Weight coal charged, lbs.	470		350.	
Products in lbs.—				
Coke	340.0 = 72.4 pr. ct.		240.0 = 68.6 pr. ct.	
Gas	74.5 = 15.8 "		64.6 = 18.4 "	
Tar	26.1 = 5.5 "		27.2 = 7.8 "	
Ammoniacal liquor	20.1 = 4.3 "		21.2 = 6.1 "	
	460.7	98.0 "	353.0	100.9 "

Expressing these results in a little more customary manner, and adding a few more data, we get Table II.:

TABLE II.—*Yields per Ton Coal.*

	Test 5.	Test 6.
Coke, pounds.	1,484.00	1,372.00
Gas, cubic feet.	9,260.00	10,780.00
Tar, gallons.	11.60	15.60
Ammoniacal liquor, gallons.	10.30	14.40
Ammonia (NH_3), pounds.	3.95	4.58
Naphthaline, pounds.	5.95	10.04

This makes a distinctly better showing for the light charge, but it may be urged that the comparison is unfair to the heavy charge, which might advantageously have been left in the retort another hour. There is some truth in this, but assuming that the gas would have continued to be evolved for another hour at approximately the same rate as during the last ½ hour observed, one additional hour's heating would have added 500 feet of gas to be credited to the heavy charge which would amount to an additional 1,060 feet per ton; but this would still be below the results with the lighter charge, so that although it is not possible to settle the point conclusively it appears as if the heavy charge would, even if heated longer, have produced a smaller yield of gas per ton. An inspection of the curves of Plate IV. shows that another hour's heating would not have added much to the tar and that the ammonia had begun to fall off so rapidly that another hour's heating would have added only a relatively small amount to that, so that the yield of tar and ammonia per ton of coal would have undoubtedly been less with the heavy charge. On the other hand the naphthaline per ton of coal was 75 per cent. greater with the light charge.

The quality of gas manufactured is also as important as the quality, but the relative candle power of the gas in the 2 cases could not be determined since the experimental plant is not equipped with a photometer bench. The chemical analysis of the gas should afford an indication of the difference by comparison of the percentages of "illuminants." The term illuminants is here taken to mean the sum of the hydrocarbon vapors and the unsaturated hydrocarbons. The two tests start out almost together in this respect and end with a small advantage for the heavier charge. The analyses of the successive periods of test 5 form when plotted almost a straight line, as shown in Plate IV. The analyses of test 6 are unfortunately not complete. The first analyses show about the same results as test 5 but the illuminants in the only other sample taken during the first 2 hours drop so far below what might be expected that it seems it certainly must be an error and that it is best to regard the evidence with regard to quality of gas as inconclusive.

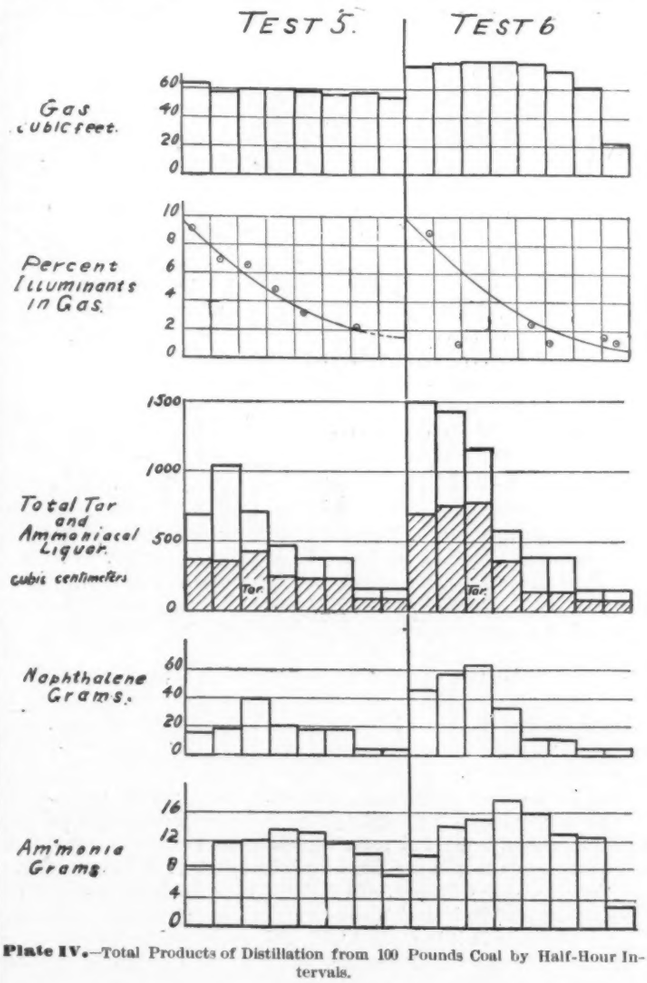

Plate IV.—Total Products of Distillation from 100 Pounds Coal by Half-Hour Intervals.

Products of Distillation in Successive Half-Hour Intervals.—The yield of products by successive ½-hour intervals, reduced to a unit weight of 100 pounds coal, is shown graphically in Plate IV. The rate of evolution of gas holds fairly steady throughout all 4 hours of test 5, but drops off rapidly during the last hour of test 6 with the lighter charge. The liquid products of distillation show a greater variation. The light charge starts off with a heavy yield of tar and water the first ½ hour. The water decreases rapidly and fairly regularly for the first three ½ hour periods, and then stays quite steady at ¼ of its initial amount till the last hour. The tar on the other hand though it starts high, increases slightly for the first three ½ hours and then drops abruptly. There is thus a large drop in the liquid products of distillation at the end of the third ½ hour, but somewhat unexpectedly, the yield of gas, instead of showing a corresponding drop, starts nearly constant for 3 more ½ hour periods.

The effect of the heavy charge of test 5 shows itself in a low yield of tar and water per 100 pounds of coal during the first period, followed by a heavier yield during the second ½ hour, but one which is still not so high as test 6. The tar reaches its maximum during the third ½ hour as in test 6, and then falls off much more gradually than in the case of the lighter charge.

The striking feature of these results is the very large amount of tar

and water evolved during the first part of the run by the light charge and the sudden slackening of liquid products 1½ hours before the yield of gas slackened.

A study of the rate of naphthaline formation shows that the rates of production of tar and naphthaline are fairly concordant. The curves showing production of tar and naphthaline in Plate IV. show corresponding irregularities, but the rate of naphthaline evolution on the whole increases more rapidly than that of the tar. As the relation of tar to naphthaline is an important one the weight of naphthaline produced per 100 pounds of tar in each successive interval is given below:

TABLE IV.—*Pounds Naphthaline Per 100 Pounds Tar.*

Half-Hour Periods.	Test 5.	Test 6.
1	3.7	5.5
2	4.4	6.3
3	7.6	6.8
4	6.9	7.7
5 and 6	7.0	8.3
7 and 8	6.9	11.3

In test 6 the ratio of naphthaline to tar increases slowly from beginning to end of the test. In test 5 it takes a bound in the third ½ hour and then drops back a little and stays almost constant to the end. It would be idle from the data at hand to speculate on the reasons for these differences. As a consequence of them, however, we might expect that, if naphthaline trouble were to be encountered at any time in test 5, it would be in the third ½ hour, and that in test 6 the trouble would increase towards the end of the test.

The yield of ammonia (NH_3) as shown graphically in Plate IV., presents the most regular succession of changes of the set. In both tests the evolution of ammonia increases gradually for four ½-hour periods and then decreases at about the same rate. Each charge shows a rather decided drop during the last ½ hour, the drop in the case of the light charge being very marked. The yield of total ammonia was calculated from analysis of the individual samples of ammoniacal liquor collected and from determinations of the amount of gaseous ammonia still in the gas at the inlet to the P. & A. separator.

Work of the Condenser.—In designing the condenser for the experimental plant the intention was to make it long enough to allow the gas to remain in it in contact with the tar vapors as long as is customary in commercial practice. This would give an unduly large amount of condensing surface with our small 3-inch pipe, but the condenser was installed that way with the idea that it was easier to cut out sections if it was too large than it would be to put in sections to make it larger. The condensers, including under that name all the pipe between the standpipe of the retort and the P. & A. tar separator, as originally built contained 32 feet of 4-inch pipe and 184 feet of 3-inch. This gave it 228 square feet of condensing surface which corresponds to over 400 square feet per 1,000 feet of gas per hour. The preliminary tests showed that the cooling effect of this long condenser was too great to bring the gas to the inlet of the P. & A. tar separator at anything like commercial temperature. Even when the condenser was preheated by a steam jet, and the pipes of the condenser covered closely by a large tarpaulin, the temperature at the inlet to the P. & A., which started at 120° F., fell in an hour to 80° and before the close of the run to 60° F. It might have been possible to jacket the condenser more efficiently and keep the temperature up for a longer time, but it was evident that nothing like a uniform temperature could be obtained at the outlet of the condenser without some external means of varying the cooling effect of the condenser as the distillation of the charge progressed and the amount of gas to be cooled, and especially of steam and tar to be condensed, diminished. The condenser was, therefore, altered to try and keep the gas at the inlet of the P. & A. at a more uniform temperature. In tests 5 and 6 the top bar of the condenser proper was provided with an external water spray and the lower part of the condenser disconnected, the gas passing as directly as possible from the top bar of the condenser to the tar separator. This cut the condensing system to about ½ of its former size and diminished correspondingly the amount of time during which the gas remained in contact with the tar before the tar separator. The temperature at the inlet to the P. & A. in tests 5 and 6, starting at 120° F., dropped to 100° F. in 2 hours and then slowly to 80° F. at the close of the test. The manner of condensing the gas in these two experiments then differed from the usual commercial practice in that the gas was cooled more quickly and more completely than customary in the gas works.

The work performed by the condensers in the two tests is best studied in Plate V. In the condensing system the unit of comparison is

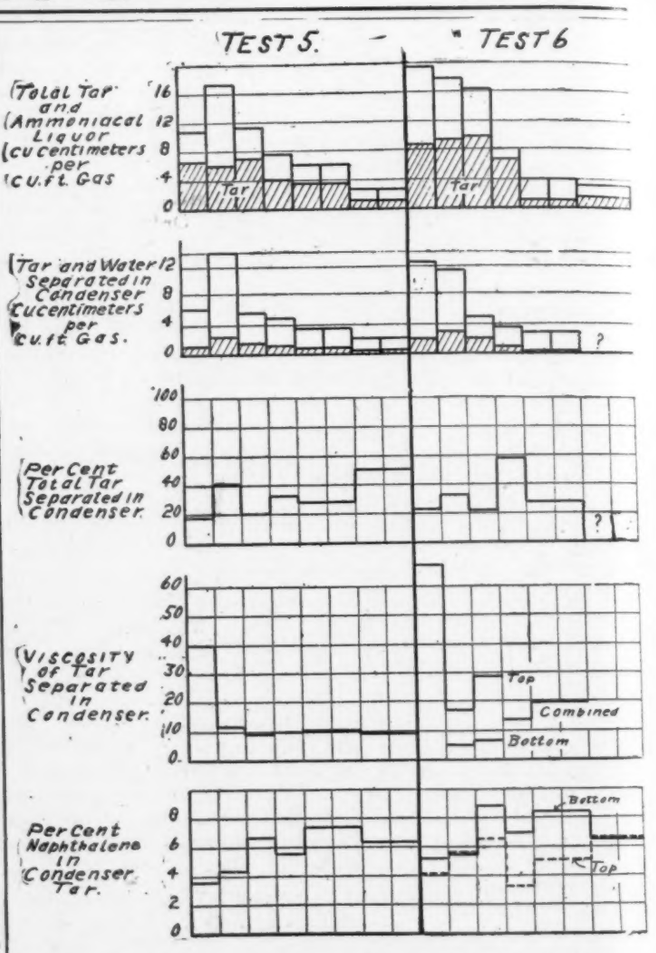
TEST 5.
TEST 6
Total Tar and Ammoniacal Liquor cu centimeters per cu. ft. Gas
Tar
Tar and Water Separated in Condenser cu centimeters per cu. ft. Gas.
Per Cent Total Tar Separated in Condenser.
Viscosity of Tar Separated in Condenser.
Top
Combined
Bottom
Per Cent Naphthalene in Condenser Tar.
Bottom
Top

Plate V.—Data on Products from Condenser by Half-Hour Intervals.

usually a cubic foot of gas instead of the pound of coal, so that the total yield of tar and ammoniacal liquor is shown again calculated to a basis of cubic centimeters per cubic foot of gas, and below those charts the amounts separated by the condenser. It will be observed that practically all the water (an average for both tests of 93.5 per cent.) separates out in the condenser, and that a portion of the tar, varying rather irregularly from 18 to 50 per cent. of the total amount, and averaging about 30 per cent., is also separated there. The fine globules of water first formed apparently coalesce readily to form drops of sufficient size to settle out of the gas stream, and so the water is nearly completely removed. The tar, on the other hand, although at the temperature of the condenser, must be nearly as completely condensed to fine globules, resists the agglomerating process by which larger tar globules are formed and hence settles out in a much smaller degree. We may surmise that it is because of the higher surface tension of the tar particles, but there is no absolute evidence of it. Neither is there any clear reason why the condenser should be so irregular in its manner of removing the tar. In the hope that viscosity might offer some explanation, the viscosity of the tar separating from the condenser in the two experiments were determined. The Engler viscosimeter was used, and the temperature chosen was 110° F., which would be about the average temperature of the gas leaving the condenser. The tests did not throw entire light on the question, but did show a variation in viscosity during the test which was unexpected and seems worth noting.

It had been expected that the first tar to come off would be the most fluid, and that with increasing temperature the tar would become more viscous. On the contrary, the very first tar flowing from the condenser was the most viscous of the series. The results are reported graphically in Plate V., the ordinates being time in minutes for 50 cubic centimeters of tar at 110° F. to flow from the Engler viscosimeter. In test 5 the tars from the top and bottom drips of the condenser were combined to a single sample whose viscosity was determined making only 1 curve for the condenser tar. In test 6 an attempt was made to differentiate between the tar from the top and bottom drips, but complete curves could not be obtained because the

samples were not always large enough for the tests. The tests are too few to be conclusive, but on the whole indicate that the more viscous the tar the less readily is it removed in the condenser. This is an unexpected result which requires confirmation. There has not been time to investigate the cause of the very high viscosity of the tar of the first period, but we hope to take it up later.

Work on the P. & A. Separator.—It was desired to make a careful test of the action of the P. & A. tar separator. Ordinarily in works' practice the separator is filled with tar to the level of the overflow, and the tar as separated displaces an equivalent amount which runs out of the overflow. We desired to know not only the amount of tar separated during each period, but also its quality, and necessarily adopted a different procedure. At the beginning of a test the separator was filled with ammoniacal liquor drawn from the works and at the end of each period the dripcock at the very bottom of the separator was opened cautiously and the tar with a small amount of liquor was drawn off. More ammoniacal liquor was then run into the P. & A. to replace the volume of the tar and liquor drawn off, so that the level of liquor in the P. & A. was kept constant throughout the test.

The gas came to the tar separator at a temperature varying from 115° F., in the early part of a test, to 80° F. at the end of a test. In its passage through the condenser an average of 93.5 per cent. of the condensable water had separated out, leaving 6.5 per cent. of water mist entering the P. & A. Our figures do not show that any appreciable amount of this residue was separated in the P. & A. Some of our tests even show an apparent slight increase in this suspended water at the outlet, due either to faulty sampling or possibly to splashing in the interior of the separator. If the temperature of the gas entering had been hotter there would undoubtedly have been condensation of water in the separator, but so far as we can determine the amount of suspended water at the outlet of the P. & A. was in our case the same as at the inlet.

The next point to be considered is the removal of tar by the separator. It may be recalled that, in a paper[1] read before your Association a year ago, we recalled attention to the difficulties of getting a fair sample of the crude gas owing to the non-uniformity of distribution of the tar particles in the cross section of the main. In a recent paper before the Manchester (England) District Institution of Gas Engineers, Messrs. Clayton and Skirrow[2] have discussed this question and laid down directions for sampling which they believe insure accuracy. They draw their samples from a point ¼ of the diameter from the side of the main, which they say is the point of average velocity. The theoretical point for mean velocity in a perfectly smooth pipe free from curves is, however, distant from the center of the pipe by a distance about ⅛ of the radius of the pipe instead of ¼, as Messrs. Clayton and Skirrow have placed it. Furthermore, as Threlfall has shown[3] by his very careful experimental study, practical conditions are very different from theoretical. His experiments show that the radius of mean velocity varies from .72 to .84 of the radius of the pipe, according to the velocity of the gas stream and the size of the pipe. In one case of a 16-inch main examined at a distance of 30 feet from the nearest bend, the radius of mean velocity was .9 the radius of the pipe. Threlfall's own conclusions are that the point of mean velocity of the gas must be determined experimentally in every case. It is probable that Messrs. Clayton and Skirrow's figures on the efficiency of various types of tar separators are reasonably accurate, for as we said of our own tests last year: "The results" (of tests conducted as ours were) "on amount of tar coming to and leaving the P. & A. are roughly comparable with one another on account of agreement in method of sampling employed, but do not necessarily represent a fair average of the conditions prevailing in a gas main." It does not seem possible with a simple sampling device to determine very accurately the suspended tar in gas mains, particularly when there is a large amount of such tar present.

Fortunately in the tests reported here we are not compelled to trust to the accuracy of indirect methods to determine the amount of tar separated by the P. & A., for we have the direct volume of tar separated in each period. The only point upon which there may be doubt is the exact weight of the small amount of tar which is left in the gas at the outlet to the separator. But this amount is so small that even a considerable percentage error would not seriously affect the calculation of the percentage elimination of tar in the separator, so that the figures on elimination of tar in the separator are believed worthy of confidence. The amount of tar eliminated figured in cubic centimeters per cubic foot of gas is shown graphically in Plate VI., and the percentage elimination is given below:

TABLE IV.—*Elimination of Tar by P. & A. Tar Separator.*

Half-Hour Periods.	Test 5. Av. Temp. Inlet P. & A. Degs. F.	Test 5. Per Cent. Tar Removed.	Test 6. Av. Temp. Inlet P. & A. Degs. F.	Test 6. Per Cent Tar. Removed.
1.....	106	93.7	115	98.7
2.....	113	94.1	114	98.6
3.....	109	96.5	113	96.7
4.....	102	92.5	105	97.8
5 and 6.....	94	92,0	95	94.5
7 and 8.....	84	84.5	84	96.5

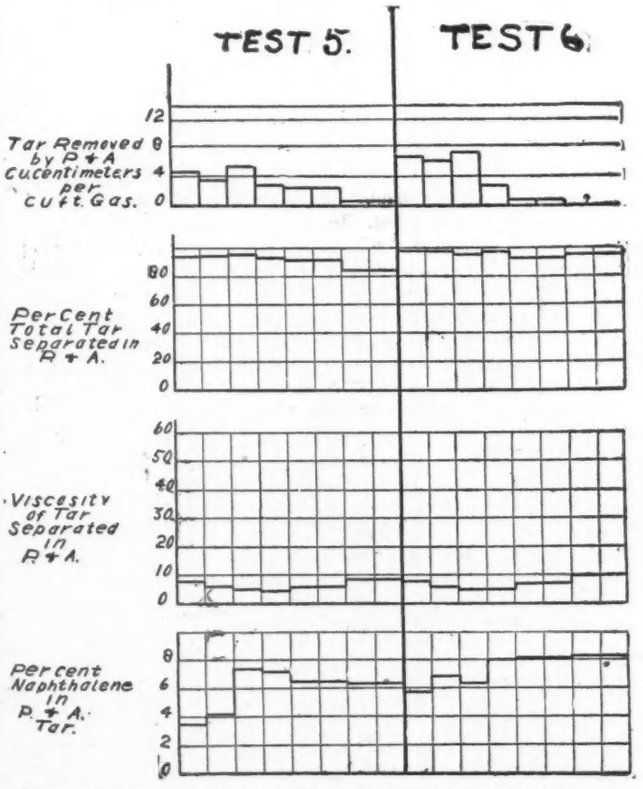

Plate VI.—Data on Products from P. & A. Tar Separator by ½-Hour Intervals.

The average percentage elimination for test 5 is 92.2 and for test 6, 97.1. The elimination in test 6 is superior to test 5. The external conditions, such as management of condensing system, temperature at inlet of separator, differential pressure, etc., being nearly the same, we are driven for a possible explanation to ascribe it to the difference in the properties of the two tars due to differing conditions in the retort resulting from the widely different weights of coal charged. The viscosities of the tars drawn from the tar separator have been determined and are shown graphically in Plate VI. As was the case with the condenser tars the viscosity was determined at 110° F., and the results indicate the time in minutes required for 50 cubic centimeters of tar to flow from the Engler viscosimeter. The figures on viscosity are given below:

TABLE V.—*Viscosity of Tars from P. & A. Separator.*

Half-Hour Period.	Test 5.	Test 6.
1.....	7.7	8.0
2.....	6.0	6.2
3.....	5.0	5.3
4.....	4.9	5.0
5 and 6.....	5.1	7.0
7 and 8.....	8.2	9.7

These tars again show a relatively viscous tar at the first of the run, the viscosity diminishing to the middle and increasing at the end of the run, but there is no connection apparent between this viscosity and elimination of tar by the P. & A. separator. A large number of tar distillations have also been made in an effort to account for their different behavior; but no definite conclusions are discernible yet.

The Elimination of Naphthaline.—Test 5 showed very little naphthaline in the gas at the outlet of the P. & A. except in one period, the third ½-hour, when, as noted before, the production of naphthaline

1. See JOURNAL, Oct. 1, 1906, p. 579.
2. *Gas World*, June 8th, 1907; *Journal of Gas Lighting*, June 4th, 1907.
3. "Proceedings Institution of Mechanical Engineers," 1904, I., 245.

was exceedingly high. The tar did its best to take care of the excess of naphthaline, the percentage of naphthaline in the tar drawn from the P. & A. jumping from 4.2 per cent. in the second ½ hour to 7.4 per cent. in the third ½ hour, but it could not take care of it all and the gas left the P. & A. containing .009 grams of naphthaline per cubic foot, which would correspond to a saturation temperature of 49° F. This is only a small amount of naphthaline and would not have caused trouble ordinarily in a works. In test 6 a small, but fairly constant, amount of naphthaline was present in each test, corresponding to a saturation temperature of 33° to 37° F. This again was too little naphthaline to cause any trouble. Practically all the naphthaline had been dissolved out by the tar.

It may be interesting now to trace the removal of naphthaline by the tar. In test 5 each lot of condenser and separator tar was analyzed for naphthaline, and in test 6 a still further differentiation was made of the condenser tar, that from the upper and hotter part of the condenser being tested separately from that depositing during and after the water cooling. The various analyses are shown graphically in Plates V. and VI. It will be sufficient to present here the averaged results:

TABLE VI.—*Elimination of Tar and Naphthaline.*

	Test 5		Test 6	
	Per Cent. of Total Tar Separated.	Composition of Tar Pr Ct. Naphthaline.	Per Cent. of Total Tar Separated.	Composition of Tar Pr.Ct. Naphthaline.
Upper condenser....	17.1	5.8	13.7	5.4
Lower condenser....	11.8		12.6	6.9
P & A.....	65.0	5.9	72.4	7.3
Tar passing P. & A.	6.1		1.3	
	100.0			

The tars separated at the higher temperature of the upper part of the condenser contain 6 per cent. of naphthaline. In test 5 the total naphthaline was so low that the tar could dissolve it all without the naphthaline being over this figure. In test 6 on the other hand the tar in taking out all the naphthaline had to absorb as high as 7.3 per cent. of its weight. There is no evidence to show whether or not it could have taken up more had it been given an opportunity. At the beginning of the paper it was shown that the amount of naphthaline formed per pound of coal was 70 per cent. greater in test 6 than in test 5, while the tar was only about 40 per cent. greater. Nevertheless this tar was able to dissolve the increased naphthaline so completely as to leave only a harmless trace remaining in the gas at the outlet of the P. & A. separator.

Work on the Tar Washer and the Scrubber.—We have not studied the action of the tar washer and scrubber nearly as completely as that of the condenser and tar separator. This was partly because, at the beginning of the work, we did not desire to make the tests any more complicated than they already were, and partly because of the difficulty of getting direct measurement of the action of these pieces of apparatus. The amount of tar separated in them is so small that the quantity remaining sticking to the various interior surfaces of the apparatus is disproportionately large, and hence only a small portion of the tar separated appears at the drips to be measured. In continuous operation the surfaces would eventually all become coated and the difficulty would disappear, but it has not seemed practicable to make a detailed study of their action on a single 4-hour charge. The purifier had not been connected at the time of these tests, and the only tests made were for tar and naphthaline at the inlet of the meter. In test 6, where only 1.3 per cent. of the tar passed the P. & A., nearly as much was found after the gas had passed the washer and tower scrubber, and had reached the meter. In test 5, where 6.1 per cent. of tar passed the P. & A. separator, there was more opportunity for the tar washer and tower scrubber, and they together removed about 75 per cent. of the remaining suspended tar, so that the gas came to the meter inlet in test 5 with about the same amount of suspended tar that was present in test 6. In this test 5, too, appeared the effect of the ammoniacal liquor upon the phenols of the tar separated in the washer and scrubber, setting free naphthaline which appeared in the gas.[1] Although in 3 out of the 4 tests made in test 5 at the outlet of the P. & A. no measurable amount of naphthaline could be found in the gas, every test at the inlet to the meter showed it in measurable amount. This naphthaline at the inlet to the meter must have been liberated from the tar in the washer or scrubber.

Summary.—The present paper, besides describing the experimental plant, gives detailed data of 2 tests on the same lot of coal, carbonized in the same retort for a 4-hour period at temperatures approximately the same. The difference between the 2 tests lies in the weight of coal charged, in test 5 a heavy charge of 470 pounds of coal and in test 6 a light charge of 350 pounds being put into the retort.

With light charging the yield was 1,520 cubic feet of gas, 4 gallons of tar and .6 pound ammonia, more per ton of coal than was obtained with heavy charging, this being offset in part by a decrease of 112 pounds of coke per ton. The amount of naphthaline formed per ton of coal was 1⅓ times as great with the light charge as the heavy, but in the tests as here reported the tar was capable of taking care of all the naphthaline and no amount that could give trouble remained with the gas. The progress of the carbonization in the retort and of the action of the condensing system is traced by ½-hour intervals.

It is not claimed that a general conclusion can be drawn from these tests, but they are presented as an interesting illustration of the differences which may arise. The great number of variables which enter into experiments of this sort make it almost impossible to decide what phenomena are produced by purely local and incidental conditions and what results are typical and may always be expected to appear with given conditions. By a compilation of a large number of tests of this sort in which all possible data are recorded, the influence of the type variables will eventually be distinguishable, and then generalizations may be drawn. This difficulty in accounting for different results has made us refrain from burdening your proceedings with unintelligible data of other tests made by ourselves. It is still more difficult to intelligibly compare the results of our tests with those of other experimenters, where every experimental factor differed from our own. We have, therefore, refrained from citing the work of preceding experimenters, leaving such comparison until we may have amassed more data of our own. It may be possible for men whose duty makes it necessary for them to daily puzzle over such obscure factors to state how far various phenomena here noted may be general and how far they are accidental. We leave the discussion in their expert hands.

1. "The Removal of Naphthaline from Coal Gas." A. H. White and D. H. Clary. Proceedings Michigan Gas Association, 1908."

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

WITH exceeding regret we chronicle the death of Mr. John Yule, who passed away the morning of September 16th, in his 63d year. Deceased was born September 12th, 1844, in Breechin, Scotland, and in his early youth became a helper in the works of the Dundee (Scotland) Gas Company, where he became thoroughly educated in the manufacture and distribution of gas, and later on in the practical supplying of electric currents. In 1881 his services were asked for by the owners of the Guelph (Canada) Gas Company, then operated by private capital. Here his knowledge of the business was so appreciated by the owners of the plant that he was speedily appointed Superintendent thereof. In the course of time the local electric concern was secured by the gas owners, and in turn, when the gas and electric plants were purchased by the city for operation on public account, he was continued as Superintendent up to the time of his death. He was a competent engineer and a progressive one, and his stewardship, under private and public direction, was of the sort that brought commendation to him. Of course, he was prominent in the public, religious and social walks of Guelph, and his different ways therein were of the type that caused his associates to respect him and to like him. His Association work was rather in line with the electric than the gas division of the Guelph plant, as will be noted from the knowledge that he was one of the founders of the Canadian Association of Electrical Engineers, and was its President for two terms—1904–05, we think. He is survived by his wife and two daughters. Five brothers also survive him, one of whom (David Yule), if we mistake not, is connected with the gas plant at Kirkcaldy, Scotland.

MR. FRANK D. MOSES has been awarded the contract for constructing the new plant for the Bluefields (W. Va.) Gas Company, the incorporation of which was recently noted in the JOURNAL. The contract covers everything for the manufacturing and distributing divisions of the plant.

WE are in receipt of two clever "printed feelers" for more business—either old or new. One is in illustrated letter sheet style, by Mr. Philip Cross, Commercial Manager of the Denver (Col.) Gas and Electric Company, who in this particular instance is out for the greater promoting of electrically illuminated signs—the visitor to Denver now might be forgiven for thinking that every business place in Denver had an electric sign in full glare; however, Cross wants them *all*. The second is a well gotten up pamphlet, the pages of which picture and narrate how useful gas is for intermittent out-of-the-way heating. The pamphlet is from "the press" of the Indianapolis (Ind.) Gas Company, and it bears the title "An Indianapolis Story with a Warm Moral." We imagine that Mr. Philmer Eves is the compiler of this well-done bit of printing.

THE *Daily Panhandle*, which is the name of the leading news publication in Amarillo, Tex., in a series of paragraphs respecting the recently installed burners and lamps of the Welsbach type by the new Amarillo Gas Company, on account of the public lighting there, is led to remark that the service is both pleasing and effective.

A FORTNIGHT ago, in reporting the current dividends on the preferred stock of the Chattanooga (Tenn.) Gas Company, which has been for some time controlled by Messrs. Child, Hulswit & Co., we said the dividend was the first one declared. This was an error, since dividends on the stock in question have been paid since April 1st, or 3 months after the present owners took hold.

MR. C. H. ROCKWELL, formerly Treasurer and Manager of the Western Gas Lamp Company, of Cleveland, O., died at his home in that city the evening of September 20th. The remains were taken to Tarrytown, N. Y., for interment. He was in his 62d year, having been born in Tarrytown, October 18th, 1845.

FROM the 1st inst., the convertible debenture bonds ($1,000,000) outstanding on account of the New Haven (Conn.) Gas Light Company's capitalizations, are redeemable in new stock, at par.

THE Massachusetts Steamship Company has been incorporated with a capital of $1,500,000, "to transport freight and passengers by water." Its officers are: President, Mr. J. L. Richards; Treasurer, Robert Grant. The purpose of the Company is undoubtedly in the main to handle crude materials for the Massachusetts Gas Companies.

THE Town Board of Brookfield, N. Y., has authorized the Waterville (N. Y.) Gas and Electric Light Company to put its lighting system over the Oriskany Falls road to the town line. It has also been authorized to transact business in the settlement of Sangerfield.

THE voters of Ventnor City, N. J., will some time this month determine whether or not that place is to buy the existing water works and to construct gas and electric lighting plants, the water and light supply to be supplied free to taxpayers, the maintenance to be made by taxation direct.

A CORRESPONDENT in Washington, D. C., forwards the following clipping from a recent issue of the Washington *Post*: "Captain Jonathan D. Cathell, a resident of Georgetown since 1849, celebrated his birthday anniversary on the 28th of September, at his home 3254 O street, N. W. In spite of his advanced age Captain Cathell is enjoying good health; and he is now 'going on 92.' For 39 years – from 1854 to 1893– Captain Cathell was Superintendent of the Georgetown Gas Light Company. For the last 55 years he has been a member of Covenant Lodge, I. O. O. F. He has also been one of the Vice-Presidents of the Oldest Inhabitants' Association of this city. He is an active member of the Congress Street Methodist Protestant Church. In 1832 he started his career as a sailor, and shipped as cook on a Chesapeake Bay craft. Later he was employed on a vessel built by his father, and sailed with his father through the Mediterranean. His first wife, to whom he had been married 61 years, died in 1899. The following year he married a second time."

MR. W. G. JENKS has been appointed Superintendent of the Lyons (N. Y.) Gas Light Company. In fact he has had charge there for quite some time. He was formerly on the staff of the Portsmouth (N. H.) Company.

THE Associated Gas and Electric Company, of Ithaca, N. Y., of which well-directed concern Mr. William T. Morris is the executive head, reports very satisfying returns from the 15 plants which it controls. During the year the Company has expended large sums in bettering the physical conditions of its properties. Notable in the latter respect comes the plant of the Homer and Cortland (N. Y.) Company, where Messrs. Deily & Fowler have completed a 2-lift holder in iron tank, rated to hold 100,000 cubic feet. At that station also has been placed a new set of purifying boxes, of the dimension of 12 feet by 16 feet, and 4 feet deep. The main system has also been gone over, many of the smaller pipes having been replaced by lines of larger diameter, and notable piping into new districts was made. At Bethlehem (Pa.) the Company authorized Messrs. Deily & Fowler to construct a relief holder up to holding 50,000 cubic feet, and the same firm was directed to add a second lift to the existing holder, bringing it to a capacity of 100,000 cubic feet. The distributing system was continued on to North Bethlehem, and the mains in South Bethlehem and Bethlehem proper were put in shape to give the residents adequate service. These details naturally have kept Messrs. Morris and Summers from a vacation period the past heated season. However, there is some, in fact much compensation in the knowledge that during the coming frigid season their peace of mind will surely be well served.

THE Consumers' Gas Company, of Atlantic City, N. J., has awarded to the Gas Machinery Company, of Cleveland, O., the contract for a purifying equipment up to a capacity of 200,000 cubic feet per diem. To an impartial observer it looks that it is up to the Atlantic City concern to order the erection of a suitable storage holder. That useful vessel will certainly be needed next season.

MR. C. W. HOY has been promoted from the post of Works' Superintendent to that of General Superintendent of the above named Company. It is queer how rapid Mr. Hoy's advancement is in New Jersey compared with that which was vouchsafed him not long ago on the south side of Long Island. Then, again, there are not so many cooks making the soup at Atlantic City as happened to be on the particular job referred to on Long Island.

UNDER the terms of the contract recently entered into between the authorities of East Orange, N. J., and the Public Service Corporation, the public lighting, in as far as that will be done by gas, is to be done during the ensuing 3 years on the following charge basis: Single burner Welsbach lamps, $27.50 each; single open flame burners, $19 each, per annum; the Company to furnish twenty 4-burner Welsbachs in the public squares, without charge. If at any time during the contract the authorities elect to keep up the contract for a full term of 5 years, a rebate of $1 will be allowed for each lamp per year on the elapsed time, and the general rate for the continued portion will be $26.50 per lamp, per annum.

THE Brockton (Mass.) Gas Light Company has petitioned the Board of Gas and Electric Light Commissioners for the right to increase its capital stock in the sum of $110,000. The present capital is $390,000.

A CORRESPONDENT in Pittsburgh, Pa., writing under date of the 28th ult., incloses the following: "The contention between the authorities of Pittsburgh, the Sun Light Company and the Welsbach Street Lighting Company over the furnishing of incandescent gas street lamps reached the legal stage this week, in the shape of a suit entered by the Welsbach Company against the city, the Sun Light Illuminating Company, Mayor Guthrie, Acting Public Works' Director A. B. Shepherd and John Maslowski, Superintendent of the Bureau of Lighting. The action was to restrain the city or the other Company from taking possession of 1,760 street lamps fitted with incandescent mantles. The Welsbach Company claimed it was notified by Superintendent Maslowski that on September 26 the city would take possession of the lamps. The trouble is over the Sun Light Illuminating Company, which was awarded the incandescent street lighting contract and has been unable to fulfill its agreement. The Welsbach Company, which had the contract last year, has been supplying the light under an agreement, but now the Sun Light Company wishes to begin work. The difficulty was being adjusted by the city, but apparently the Welsbach Company was not satisfied and went into court." To tell the truth, our correspondent adds, the Welsbach Street Lighting Company does not seem to have been treated with fairness in this Pittsburgh lighting deal, and it is hoped by many that the history of the entire affair, from the time of soliciting tenders to the awarding of the contract, be threshed out thoroughly.

"THE Board of Gas and Electric Light Commissioners, of Massachusetts, has approved the laying of the pipe line through the streets of Chelsea by the Boston Consolidated Gas Company," so writes "T. B. F.," "the line to extend from the northerly terminus of Williams street, through public streets and private rights of way to the Chelsea bridge, between Chelsea and East Boston. The Company desired such location for the purpose of connecting its works in Everett with works of the East Boston Gas Company. The Chelsea Board of Aldermen refused to grant the right, whereupon the Company appealed to the Gas Commission. The Board of Aldermen declared before they granted a permit the price of gas must be reduced to 80 cents. The Commission rules that ample jurisdiction is vested in the Gas Commission upon complaint of 20 customers of Chelsea to order such reduction."

THE authorities of Sioux City, Ia., have been conducting a series of experiments on certain streets in that city to determine the usefulness of gas tar as an agent to mitigate, if not completely suppress, the dust nuisance. So far the success of the experiments has been pronounced; and it is proposed now to put the plan into practical use on a large scale.

THE changing over of the gas supply of Princeton, Ind., from natural to artificial will involve an expenditure of $60,000. The plant is to be erected in the district known as the "B. M. A." addition.

MR. H. T. CARPENTER, writing under date of the 27th September, says that the Bristol Company, of Waterbury, Conn., is about to erect another addition to its present plant. The additional space (the new construction is to cover a plot 53 by 170, and the building is to be 3 stories high) is made neeessary by the increased demand for Bristol recorders for the registering of pressure, temperature and the like, and the Bristol steel belt lacing as well. Mr. Carpenter adds, in closing: "With the amount of business we have in sight it will be not long before even the additional space will be insufficient."

HERE is a testimonial to the unerring sagacity of Mr. H. L. Doherty, as per the Columbus (O.) *Journal* of recent date: "On the initial trip of the Lusitania Mr. Doherty was a passenger and he won the first pool on the run of the steamer amounting to $1,000. He then won the second day's pool of $1,500 and the third day's pool of $750. The other passengers began to look upon Mr. Doherty as a wizard but he saved his reputation by losing on the fourth day."

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

MONDAY, OCTOBER 7, 1907.

The Market for Gas Securities.

What can be said of a market that puts Brooklyn Union gas on a parity with Consolidated gas! Yet such was the condition that existed this week. This is not said in any sense of derogation to the former, which, at the quoted rates, is certainly 35 to 40 points under a fair value for it. Consolidated opened to-day at 101 to 101¼. Brooklyn Union was 95 to 110.

The suggested quick rise in Washington (D. C.) gas is certainly "winging." It sold at 400 this week, and 395 is now bid for it. Peoples, of Chicago, shows no particular change. It is a decided purchase at anything under 90.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

OCTOBER 7.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	101	101⅛
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	92	97
Equitable Gas Light Co.—				
Con 5's, due 1931, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	190	..
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	83	88
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p.ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	100	105
Con. 5's, due 1945, J. & J.	1,500,000	..	97	101
Standard	5,000,000	100	70	100
Preferred	5,000,000	100	100	125
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	95	110
1st Con. 5's, due 1948, M. & N	15,000,000	..	..	102
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	¼	⅝
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47¼	50
Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	5,250,000	1,000	63	66
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	93½	94
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	92	98
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	87	88
Preferred	3,026,500	100	107½	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	90
Mortgage, 6's	3,500,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	103	105
Bonds, 5's	10,500,000	..	101	102½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	105
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies of Boston	25,000,000	100	51⅛	51⅝
Preferred	25,000,000	100	81	82
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	85	86
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104⅛	105¼
San Francisco, Cal.	15,800,000	00	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¾	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	395	400
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., N. W. CORNER BROAD AND ARCH STS., PHILADELPHIA, PA., Sept. 11, 1907.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Oct. 15th, 1907, to stockholders of record at the close of business, Sept. 30, 1907. Checks will be mailed.

1684-5 LEWIS LILLIE, Treasurer.

Estimates furnished for the erection of complete gas works or the extension and modernizing of old works. All work warranted. Both water gas and coal gas.

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1686 4 Address, "HUSTLER," care this Journal.

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1687-4 Address, "Box 141," care this Journal

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By a gas company in New England, thoroughly competent man to take charge of street work, including installing valve system on high pressure line now in operation. Permanent and good position to right man.

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Applicants must inclose references, be able to work colored laborers and know how to handle half depth recuperative benches.

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16-7-2 Care this Journal.

GAS BOOKS WANTED.

My library of gas books and subjects akin thereto, and which I believe was the most complete in existence, was destroyed in the April 18, 1906, San Francisco disaster. In re-establishing this library, which will find an ultimate home with a gas association or educational institution, I am desirous of securing all available gas literature printed in the English language, including technical works, reports, pamphlets, etc., and will purchase such as I do not yet possess. Those having such works will accommodate me by sending a description thereof, stating condition of volume and net price desired, carriage included. L. P. LOWE,
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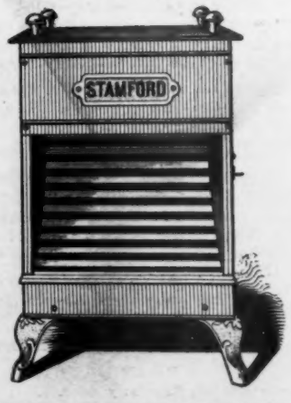

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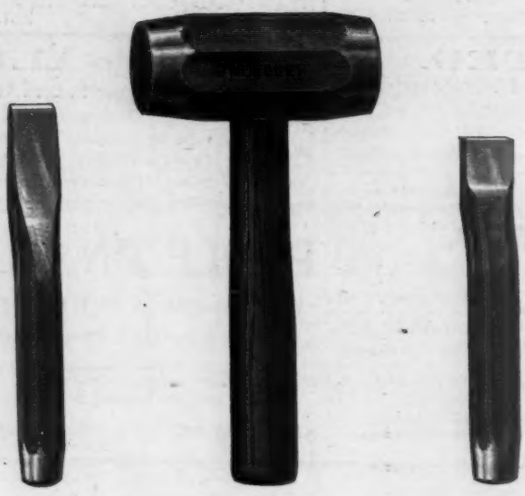

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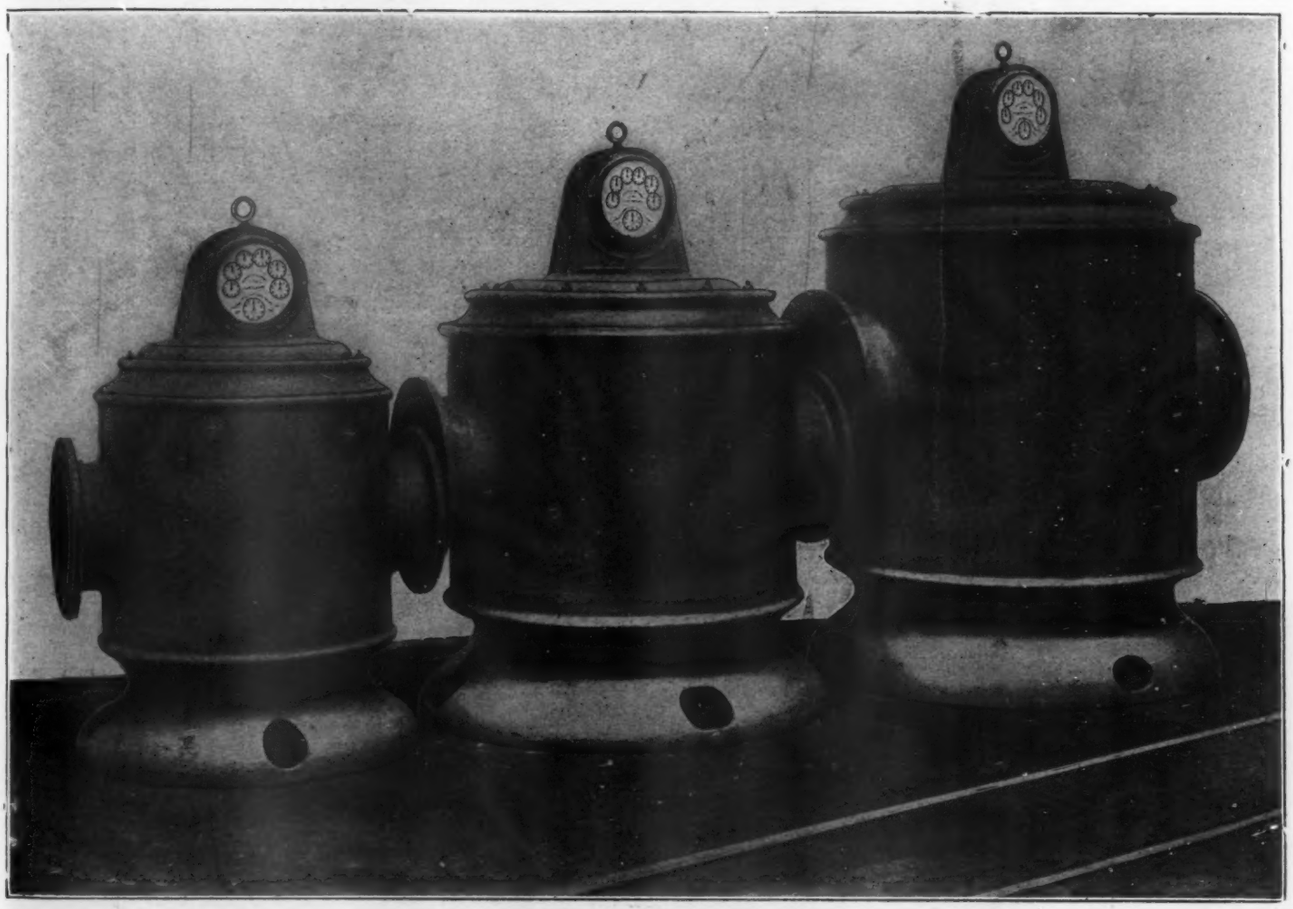

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FOR NORWICH, N. Y.	FOR EL PASO, TEXAS.	FOR CHESTER, PA.

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One-half the cost—One-tenth the space of old style wet meters.

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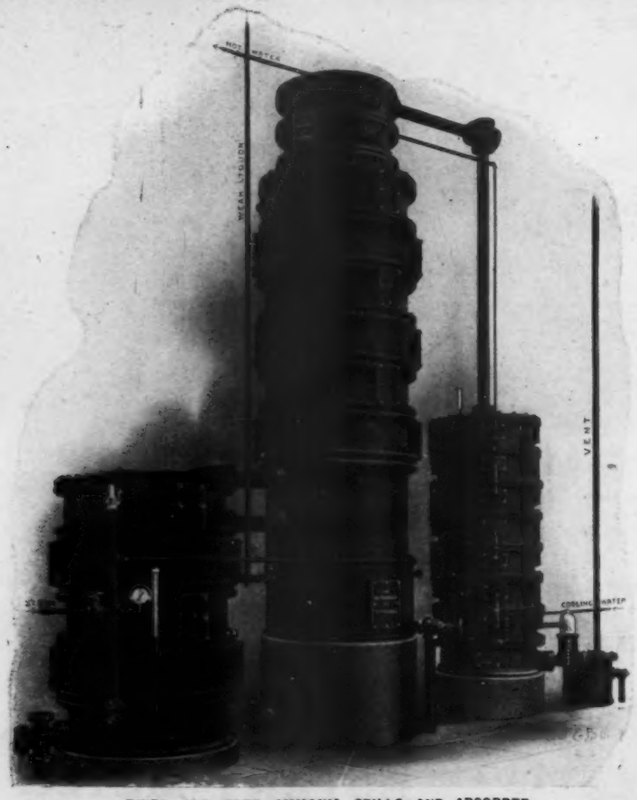

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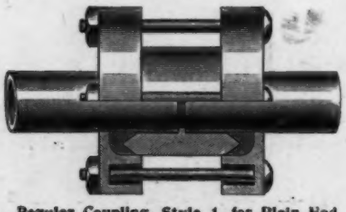
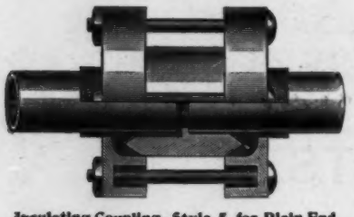

Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.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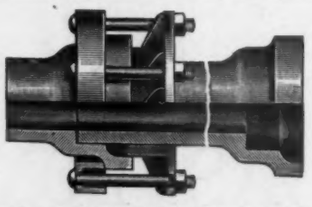
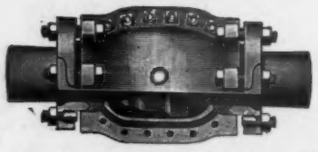
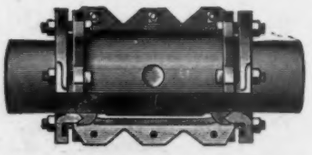
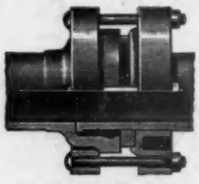

Coupling, Style 9, for Special Style Cast Iron Pipe.


Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.


Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.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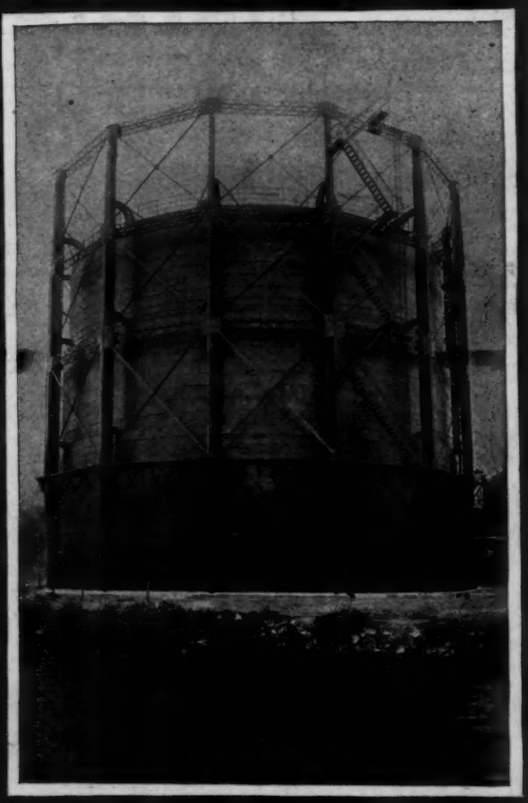

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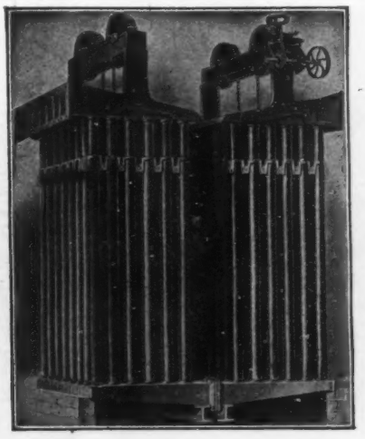

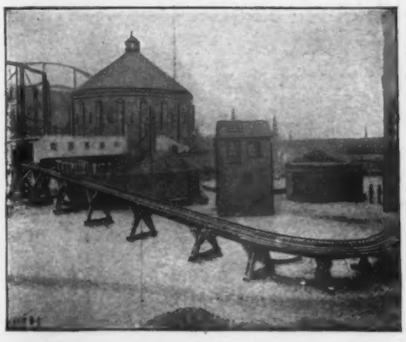

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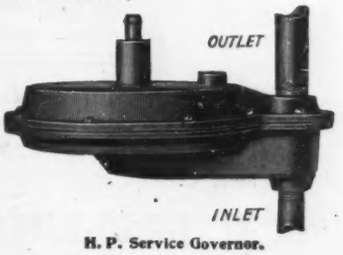

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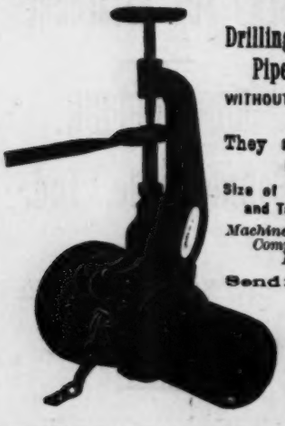

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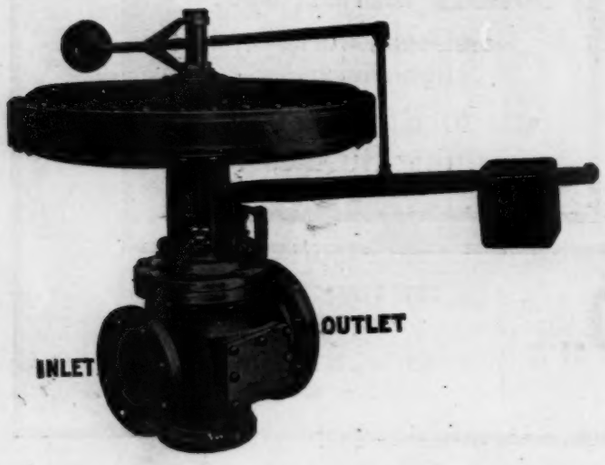

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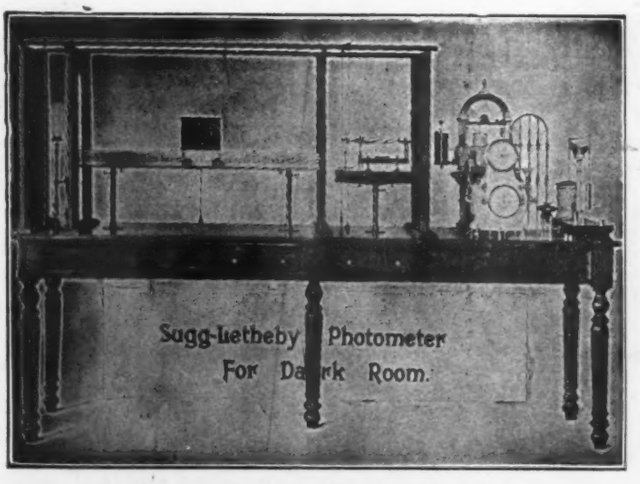
Table No. 1.
FOLLOWING THE MOON.

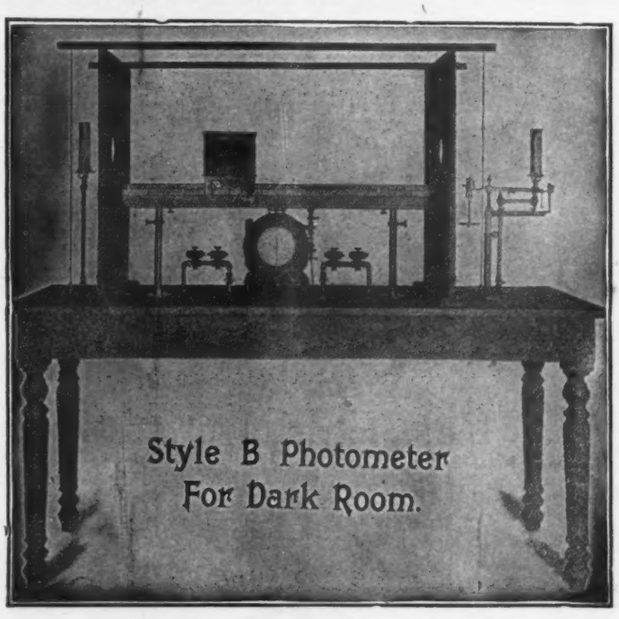
Day of Week.	Date.	Light.	Extinguish.
Tue.	1	6.10 PM	1.50 AM
Wed.	2	6.10	2.50
Thu.	3	6.10	5.00
Fri.	4	6.10	5.00
Sat.	5	6.10	5.00
Sun.	6	6.00 NM	5.00
Mon.	7	6.00	5.00
Tue.	8	6.00	5.00
Wed.	9	6.00	5.00
Thu.	10	6.00	5.00
Fri.	11	7.30	5.00
Sat.	12	8.20	5.00
Sun.	13	9.20 FQ	5.10
Mon.	14	10.30	5.10
Tue.	15	11.30	5.10
Wed.	16	12.40 AM	5.10
Thu.	17	1.50	5.10
Fri.	18	3.00	5.10
Sat.	19	No L.	No L.
Sun.	20	No L FM	No L.
Mon.	21	No L.	No L.
Tue.	22	5.40 PM	7.20 PM
Wed.	23	5.40	7.50
Thu.	24	5.40	8.30
Fri.	25	5.40	9.10
Sat.	26	5.40	10.00
Sun.	27	5.30	10.50
Mon.	28	5.30 LQ	11.40
Tue.	29	5.30	12.40 AM
Wed.	30	5.30	1.40
Thu.	31	5.30	2.40

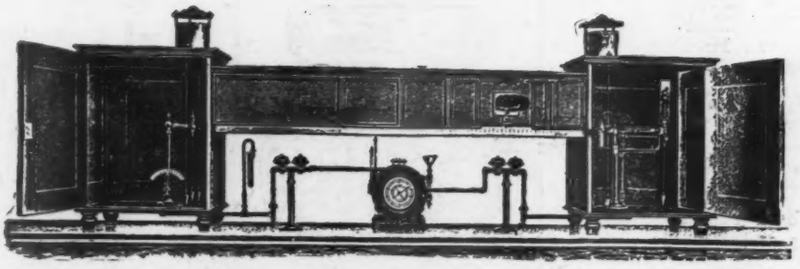
TOTAL HOURS DURING 1907.

By Table No. 1.

	Hrs.Min.
January	211.10
February	193.40
March	182.10
April	167.00
May	157.00
June	145.30
July	151.50
August	162.30
September	175.30
October	202.40
November	209.30
December	231.50
Total, yr.	2190.20







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

OCTOBER, 1907.

Table No. 2.
NEW YORK CITY.
ALL NIGHT LIGHTING.

Day of Week.	Date.	Light.	Extinguish.
		P. M.	A.M.
Tue.	1	5.30	5.00
Wed.	2	5.30	5.00
Thu.	3	5.30	5.00
Fri.	4	5.30	5.00
Sat.	5	5.30	5.00
Sun.	6	5.30	5.00
Mon.	7	5.30	5.00
Tue.	8	5.20	5.10
Wed.	9	5.20	5.10
Thu.	10	5.20	5.10
Fri.	11	5.20	5.10
Sat.	12	5.20	5.10
Sun.	13	5.20	5.10
Mon.	14	5.20	5.10
Tue.	15	5.10	5.20
Wed.	16	5.10	5.20
Thu.	17	5.10	5.20
Fri.	18	5.10	5.20
Sat.	19	5.10	5.20
Sun.	20	5.10	5.20
Mon.	21	5.10	5.20
Tue.	22	5.00	5.30
Wed.	23	5.00	5.30
Thu.	24	5.00	5.30
Fri.	25	5.00	5.30
Sat.	26	5.00	5.30
Sun.	27	5.00	5.30
Mon.	28	5.00	5.30
Tue.	29	4.45	5.35
Wed.	30	4.45	5.35
Thu.	31	4.45	5.35

TOTAL HOURS DURING 1907.

By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

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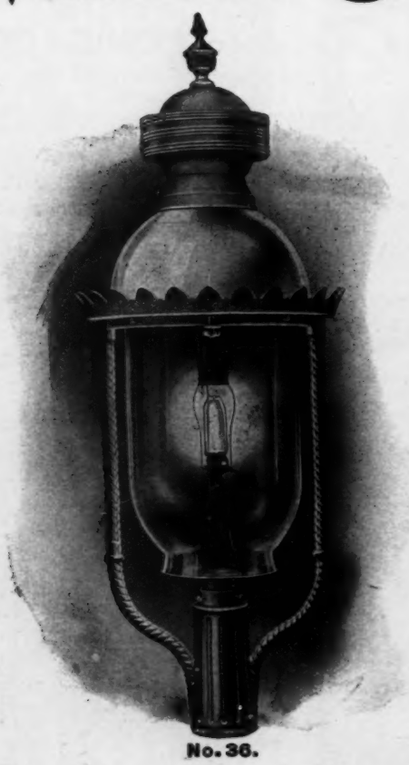
....OF AMERICA....



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Everett, Mass.
Jenkintown, Pa. (2d contract).
Coney Island, N. Y.
Mexico, Mo.
Jacksonville, Fla.
Syracuse, N. Y. (2d contract).
Atlanta, Ga. (3d contract).
Holyoke, Mass.
Peoria, Ills.
Schnectady, N. Y. (2d contract).
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Galveston, Tex. (2d contract).
Quebec, Canada.
Indianapolis, Ind. (2d contract).
Bessemer, Ala.
Waterbury, Conn. (5th contract).
Sioux Falls, S. D. (3d contract).
Philadelphia, Pa.

TOTAL SETS INSTALLED TO JULY 1, 1907, ... 34
TOTAL SETS TO DATE, ... 668
TOTAL DAILY CAPACITY, ... 541,655,000 cu. ft.

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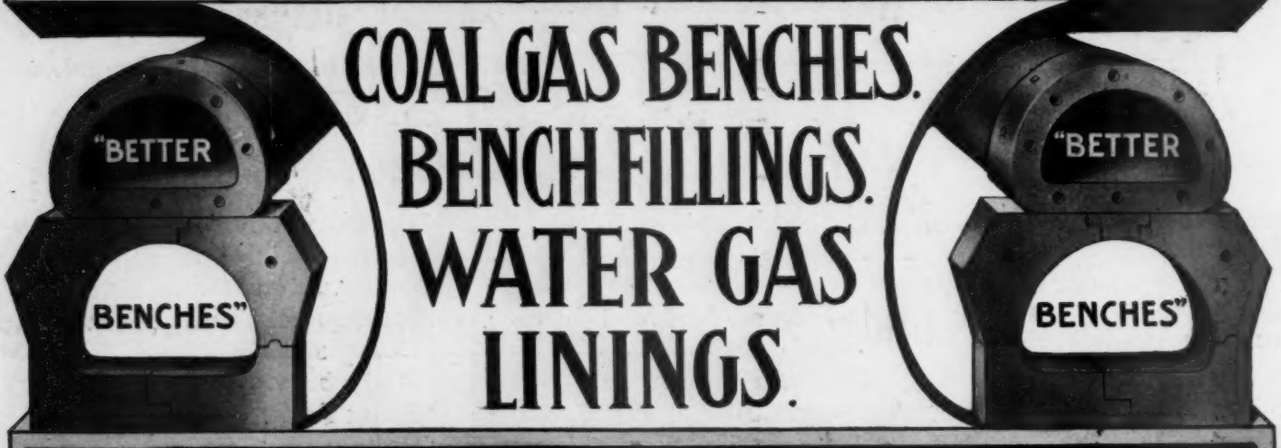

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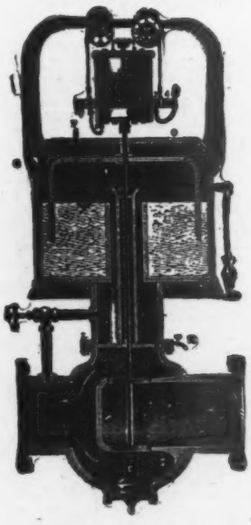

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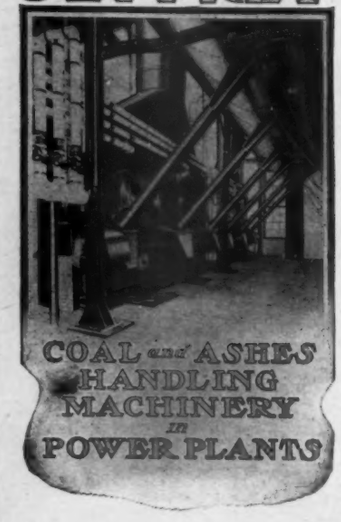

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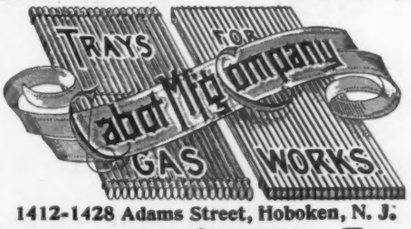

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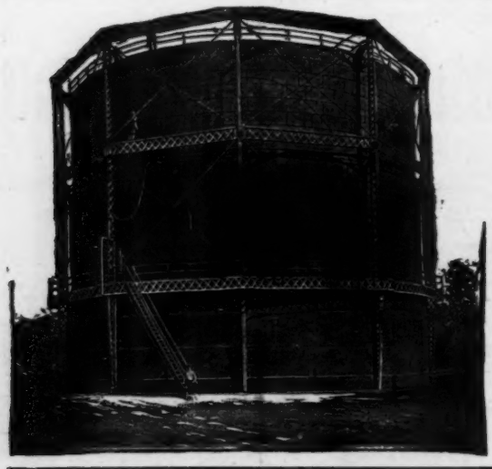

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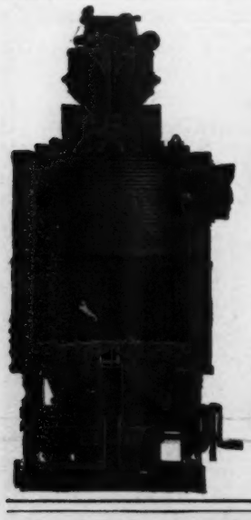

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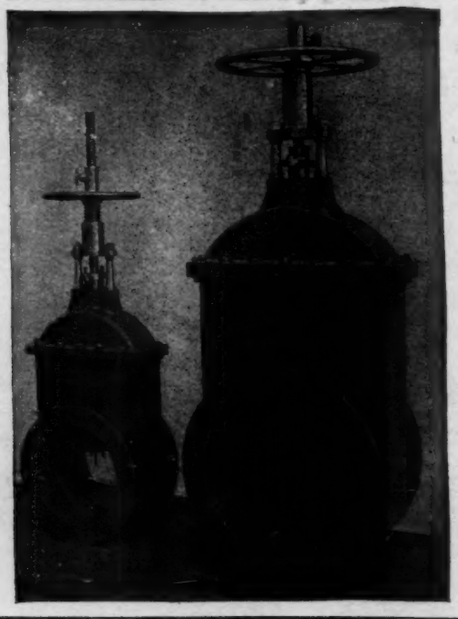

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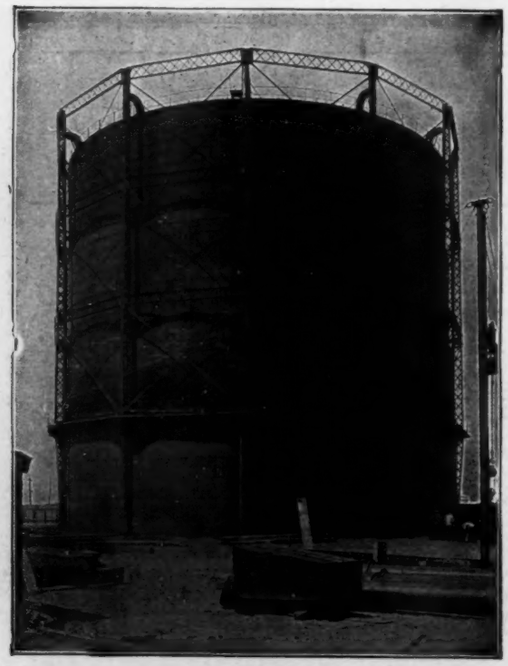

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